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ExaSAN A16S3-PS

User Guide

Includes hardware setup information for:
PCIe RAID System Models: A16S3-PS
QSFP HBA Model: Z2M-G3
QSFP PCIe Cables

Optional hardware setup information for:
PCIe Convertor: C1M
Dual DAS Port HBA: Z2D

Also includes software setup information for:
RAID Management Software:
RAIDGuard X

Accusys Storage Ltd.,

Version: V1.0

Accusys®
The RAID Architects

Revision Sheet

Release No.	Date	Revision Description
V1.0	10/08/2014	Initial release

PREFACE

Notice

The product features and specifications described in this guide are subject to change without notice.

The manufacturer shall not be liable for any damage, or the loss of data resulting from the performance or use of the information contained herein.

About This Guide

Congratulations on your purchase of the ExaSAN (pronounced X-sa-SAN) A16S3-PS, The 16 bay PCIe 3.0 rackmount model of the ExaSAN family, specifically designed for all post production storage. It delivers stability, exceptional performance, and scalable capacity.

This guide also contains instructions for installing and using the ExaSAN A16S3-PS system and RAID (Redundant Array of Independent Disks) technologies and RAIDGuard X (ExaSAN's RAID management software).

If you are new to RAID and RAIDGuard X, this guide will help you become familiar with the technology, and assist you in setting up and using RAID on the A16S3-PS. If you are already familiar with ExaSAN, use this guide as a reference for implementing your ExaSAN A16S3-PS solution to achieve maximum performance and reliability.

For details of hardware installation, setup, configuration and considerations, see

- Chapter 1, "Introducing ExaSAN PCIe3.0 Storage System"
- Chapter 2, "Preparing to Install ExaSAN A16S3-PS"
- Chapter 3, "Installing ExaSAN A16S3-PS"
- Chapter 4, "Using RAIDGuard X"
- Chapter 5, RAID Overview

Guide to Conventions

Inside the double boxes are important information that users should be aware of:

Caution
This indicates the existence of a potential hazard that could result in personal injury, damage to your equipment or loss of data if the safety instruction is not observed.

Note
This indicates useful tips on getting the most from your Accusys RAID system.

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This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

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1. Introducing ExaSAN PCIe 3.0 Storage System

1. Introducing ExaSAN PCIe 3.0 Storage System

1.1 Overview

1.1.1 What is the ExaSAN Solution

Developed by Accusys Storage Ltd., a worldwide leader in RAID (Redundant Array of Independent Disks) storage systems, ExaSAN (pronounced “X-sa-SAN”) is a family of storage and switch products that take advantage of well known PCIe (PCI Express) technology speeds, standards, and roadmap.

The current ExaSAN products employ PCIe3.0 protocol that provides 8 Gb/s per lane transfers. With 4 lane QSFP (Quad SFP) connector and cable, ExaSAN can transfer up to 32 Gb/s by using single connection. With a dual port QSFP HBA, data transfers up to 64 Gb/s.

Post production work including non-linear editing (NLE) requires high bandwidth storage to quickly move the volume of data being processed and ExaSAN storage solution meets those demands. The high bandwidth provided by ExaSAN technology allows the client to complete editing tasks in a much shorter time to save time and money.

ExaSAN solution, including its complete line of rack mount RAID systems, tower RAID systems, PCIe switch systems and accessories, support to build DAS (directly attached storage) and SAN (storage attached network) environments. Figures below depict the ExaSAN A16S3-PS system solution architecture in DAS and SAN environment.

Figure 1: A16S3-PS DAS environment

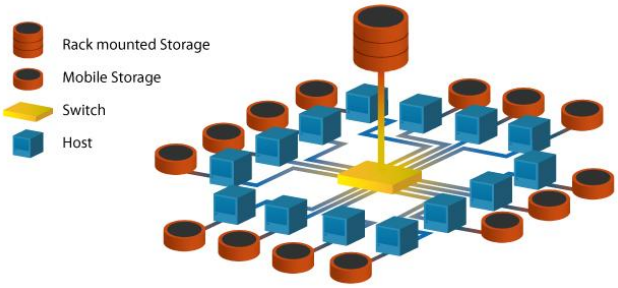


Figure 2: A typical Level 2 SAN environment

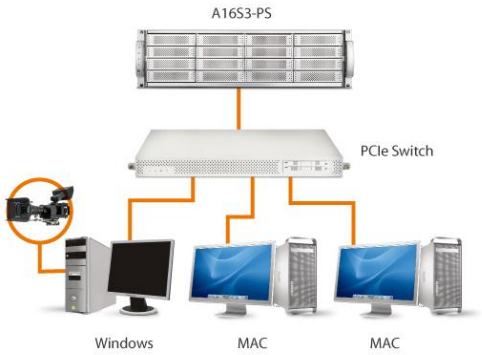


Figure 3: A16S3-PS in SAN environment

Whether it’s collaborative video editing in a post-production workgroup, or a shared research project in a university, the ExaSAN solution offers a range of performance levels and storage capacities that scale to meet the needs of small-to-medium-sized organizations. Equally important and useful is its integrated design, centralized administration and monitoring, and a suite of built-in management tools; which eliminate the need for a staff of experts to install and maintain a SAN for the workgroups.

1.1.2 ExaSAN A16S3-PS features

Below are the key features of the A16S3-PS. They are the reasons why ExaSAN is the best RAID solution for a power user, working on studio, or individual work space.

1. Host Interface

- PCIe3.0 8Gb/s x4 lanes, for transfers up to 32Gb/s

2. Disk Interface

- Support 16 x 3.5" SAS/SATA HDD(hard disks) or 2.5"SSD (flash disks)

3. **RAID Controller**

- Hardware XOR/Multi-Parity engine
- 2GB DDRII-800 memory, ECC-protected, support up to 4GB

4. Software Specifications

- Multiple RAID levels: 0,1,5,6, 0+1, and JBOD
- Up to 4 independent disk arrays
- RAID capacity partitioning: up to 16 slices
- Support up to 64 LUNs
- Variable stripe sizes: 256 (KB)
- Selective initialization method with background initialization
- Online RAID set expansion and level migration
- Controller and Disk Cache Control to optimize read/write performance
- Support write-back and write-through caching
- Automatic drive insertion/removal detection and fast disk rebuilding
- Online bad block data recovery and reallocation
- Online disk scrubbing and data refresh and parity regeneration
- Disk health monitoring by S.M.A.R.T.
- NVRAM-based transaction log and auto parity resynchronization
- Array roaming and disk traveling with redundant on-disk metadata
- Array recovery to restore RAID configurations
- Dual firmware images for firmware recovery
- Disk Lag Proof technology to guarantee disk timely response
- Equalization mode to smooth the performance of sequential data transfers

5. Management

- Java-based GUI, cross-platform executable
- Enclosure components monitoring and control via GUI
- LED indicator for RAID & enclosure status
- Event logging to text file with event viewer
- Event notification by email (SMTP)
- Centralized multiple RAID system management
- Supports both in-band and out-of-band management

- Support firmware upgrade via GUI
- Support SNMP
- Support remote management

6. Enclosure

- FAN, Power, Temperature status LED indication in the front faceplate.
- Dimensions: L: 567mm, W:441mm, H: 131mm
- Weight: 19.4 Kg (w/o drives); 42.7 lbs (w/o drives)

7. Support OS

- Windows 7, 8, 2008 and 2012 (32/64bit)
- Linux: Red Hat, SUSE, Fedora, CentOS etc.
- MAC: OS X(10.5, 10.6, 10.7, 10.8, 10.9 and later)

8. Operating Conditions

- Humidity: 5% - 85%
- Operating Temperature: 0C – 40C
- Certification: RoHS, UL, CE, FCC, C-Tick, BSMI

9. Support Host and Switch

- HBA: Z2M-G3 (PCIe3.0 x8), Z2D-G3 (PCIe3.0 x8)
- Switch: SW16, SWF16
- Convertor: C1M-G2 (Thunderbolt2.0 to PCIe)

10. Support Cable

- Copper cable:2M (standard)
- Optical cable:10M, 30M, 50M and100M (optional)

1.2 What's in the Box

Your ExaSAN A16S3-PS is shipped in special packaging to provide protection during transportation. Carefully check your carton contents against the included packing list, or the inside flap of the box, and your original purchase order. You should have the items as described in the sections below.

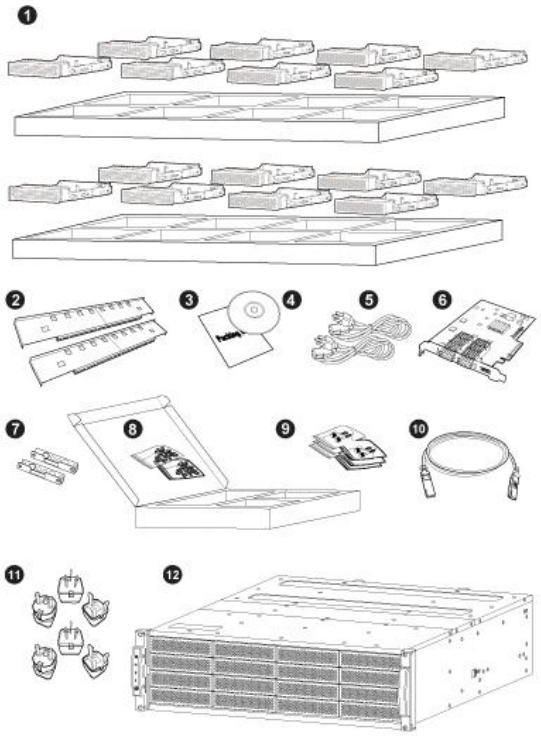


Figure 4: A16S3-PS packing list

Contact your Accusys System Integrator/Value Added Reseller or Accusys Customer Service (see Appendix C "Customer Service and Technical Support" for more information) to report any missing item.
The Accessories package includes the following items. These items can also be ordered and shipped separately from Accusys.

1. Disk tray (x16)
2. Rail set (x2)
3. Packing List (x1)
4. Installation DVD (x1)
5. AC power cord cable (x2)
6. Z2M HBA card (x1)
7. Rail extender (x2)
8. Screw pack for disk tray (x2)
9. Screw pack for disk rack (x6)
10. 2M QSFP copper cable (x1)
11. Plug adapter (x6)
12. ExaSAN A16S3-PS storage (x1)

1.3 Your A16S3-PS at a Glance

This section helps you get familiar with the physical appearance of your ExaSAN A16S3-PS.

1.3.1 ExaSAN A16S3-PS

1.3.1.1 A16S3-PS Front Panel & LED Indicators

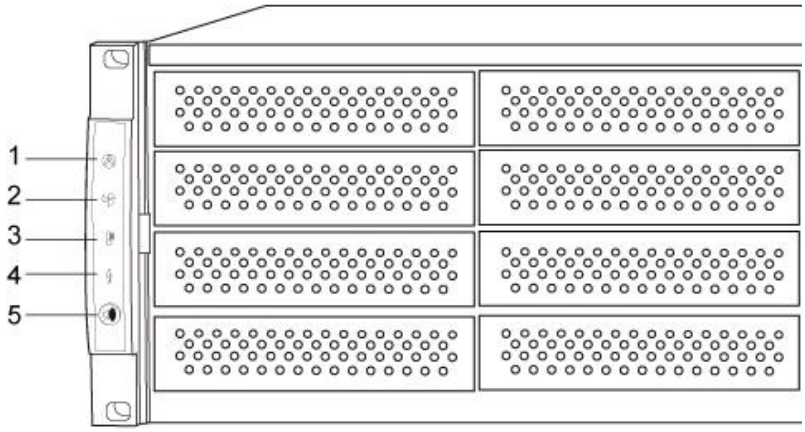


Figure 5: A16S3-PS front view

There are 5 LED indicators on the handle of the A16S3-PS

Item	Name	Description
1	Controller Status	**Steady Blue** indicates the controller is working normally. **Flashing Blue** indicates the host is accessing. **Red** indicates the controller A has failed
2	System Fan	**Blue** indicates the fan modules are working normally. **Red** indicates one or more of the fan modules failed.
3	System Temperature	**Blue** indicates the system temperature is normal. **Red** indicates the system temperature is over the value.

4	System Power	**Blue** indicates the subsystem power supplies are working normally. **Red** indicates that a power supply has failed.
5	Mute Button	Pushing the button for 2 seconds will mute the system beeper. If another abnormal event occurs, the beeper will alarm again.

1.3.1.2 Beeper Codes

Controller Status	**Beeper mode**
Turn on the Controller	One short beep
System Panic	Long beep
Disk init, rebuild, expansion, migratrion snapshot, etc.	Repeating one short beep
Error of Fan, Power, RAID, etc.	Repeating three short beeps
System cannot bootup	Repeating three rapid short beeps

1.3.1.3 Disk Mapping

Disk 1	Disk 5	Disk 9	Disk 13
Disk 2	Disk 6	Disk 10	Disk 14
Disk 3	Disk 7	Disk 11	Disk 15
Disk 4	Disk 8	Disk 12	Disk 16

1.3.1.4 Disk Tray and LED Indicators

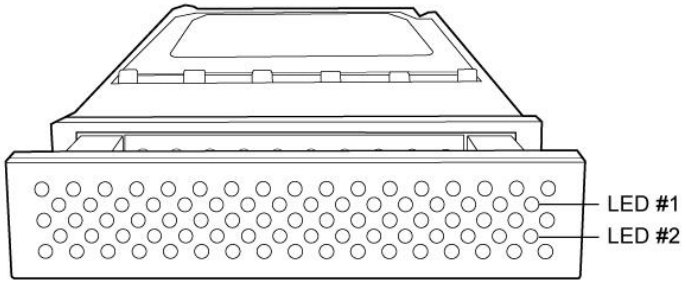


Figure 6: A16S3-PS tray front view

Disk Status	**LED #1 (Access LED)**	**LED #2 (Power/Failure/Status LED)**
Disk Online		Steady Green
Disk Fail		Steady Red

No Disk		Steady Red
Disk Locked		Steady Green
Disk Access	Flashing Blue	Steady Green
Disk Initialization	Flashing Blue	Steady Green
Disk Rebuild	Flashing Blue	Repeating switch in Red and Green
Disk Expansion	Flashing Blue	Extend Drives: Steady Red Original Drives: Steady Green
Disk Migration	Flashing Blue	Migrating Drives > Original Drives • Migrating Drives: Steady Green • Original Drives: Steady Green Migrating Drives < Original Drives • Migrating Drives: Steady Red • Original Drives: Steady Green Migrating Drives = Original Drives • Migrating Drives: Steady Green • Original Drives: Steady Green

1.3.1.5 A16S3-PS Rear Panel

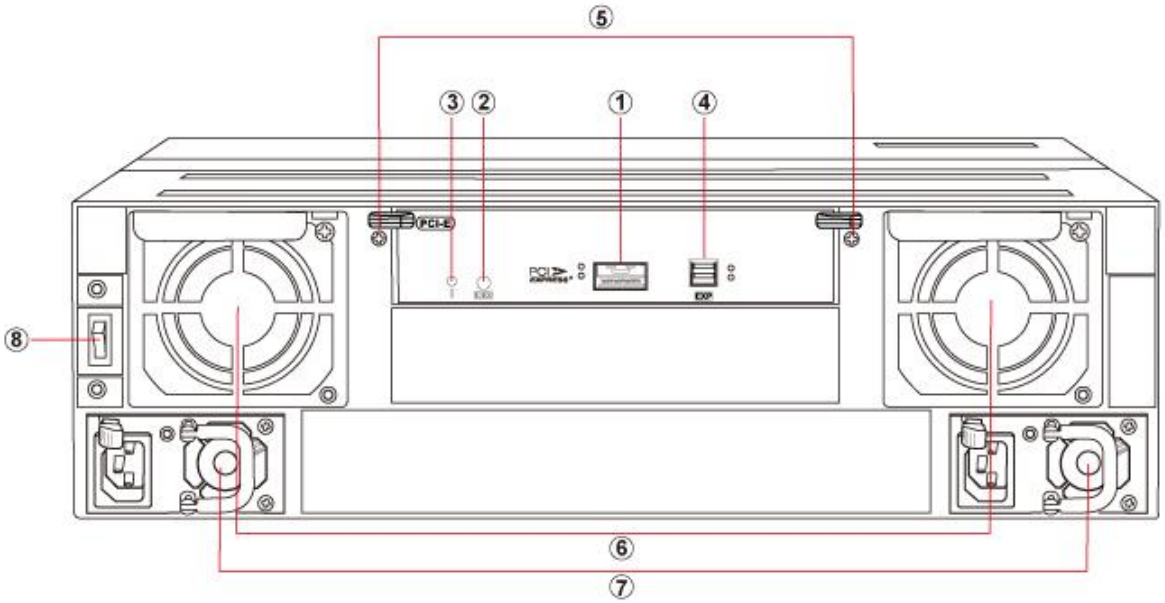


Figure 7: A16S3-PS back view

No.	Name	Description
1	PCIe port	Connects to the host server or switch. Top LED indicates IO access and lower LED indicates link status.
2	Debug port	For engineer debugging only.
3	Heart beat LED	Flashing green indicates work normal.
4	Expansion port	Expanding to another JBOD enclosure.
5	Controller Handler	Plug in/out controller for maintenance.
6	Redundant Fan	Hot swappable cooling Fan modules
7	Redundant Power	Hot swappable Power Supply modules
8	Power switch	Switch on/off the RAID system

1.3.1 Z2M-G3

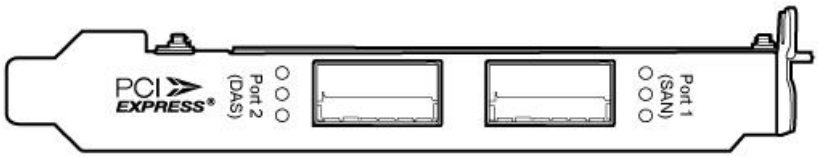
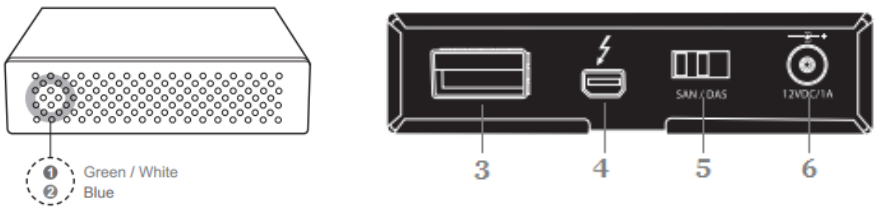


Figure8: HBA LED indicators

No.	Name	Description
1	QSFP Port 1	For connection with switch.
2	QSFP Port 2	For connection with A16S3-PS directly.

Refer to Z2M-G3 document on website (http://www.accusys.com.tw/products/accessories/hba-cable/document.html) for more detail.

1.3.2 C1M-G2



No.	Name	Description
1	Mode/Access indicator	DAS mode in **green**/ Flash when data transfer is occurring SAN mode in **white**/ Flash when data transfer is occurring
2	Link indicator	Blue light on when PCIe link up
3	QSFP port	For ExaSAN storage or switch host port
4	Thunderbolt port	For Thunderbolt 2.0 host
5	SAN/DAS mode switch	Set to SAN or DAS mode
6	Power	12V power

Refer to C1M-G2 document on website (http://www.accusys.com.tw/products/accessories/c1m-new/document.html) for more detail.

1.4 What Else You Need

When you purchased your ExaSAN system, additional hardware, software and accessories may be required to fully take advantage of this system. The following describes the software and hardware which you may need to purchase separately. If you still have questions, please consult with your ExaSAN reseller for more details.

1. **Disk drive:** A16S3-PS supports both SAS and SATA interface HDD/SSD drives in 3.5" and 2.5" dimension. Recommend using Enterprise level of the same model, size, and firmware. The A16S3-PS HDD compatibility list is on the Document section of A16S3-PS's web page.

2. **Host system computer:** When connecting A16S3-PS, you will need a host workstation or server with an available PCIe3.0 x8 (or larger) slot to install the ExaSAN HBA. Please confirm manufacturer's specifications for PCIe3.0 support to get 32Gb/s transfers from the A16S3-PS.

> **Note**
> Accusys cannot guarantee ExaSAN product compatibility with all workstations and motherboards on the market, so please check with your supplier before installation.

3. **Driver Software:** A16S3-PS required Firmware/ Driver/ BIOS/ GUI are all included in the DVD ROM inside A16S3-PS package. Also, you can download it from the website (http://www.accusys.com.tw/support/download.html), folder path is /Download /ExaSAN /ForDAS or ForSAN.

4. **Thunderbolt Convertor - C1M (optional):** If you want to directly connect ExaSAN storage with host server via Thunderbolt, you may need a C1M (http://www.accusys.com.tw/products/accessories/c1m-new.html) to convert Thunderbolt to PCIe, shows as below connection.

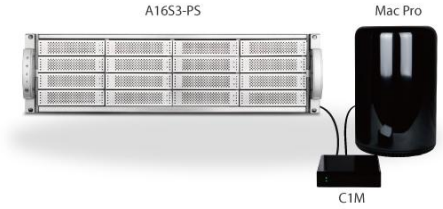


Figure 9: C1M with DAS connection to Mac host

5. **Dual DAS port adapter - Z2D (optional):** If you need twice times of A16S3 performance to work on, you need a Z2D (http://www.accusys.com.tw/products/accessories/hba-cable.html) to connect 2 sets of A16S3, and striping them through operation system's software to create a bigger and faster storage device.

2. Preparing to Install ExaSAN A16S3-PS

2. Preparing to Install ExaSAN A16S3-PS

To ensure safe and smooth operation of your ExaSAN A16S3-PS, it is essential that you choose an appropriate location for the system, provide an appropriate operating environment, and adequate power for all components of the system. As you plan for installation, follow the guidelines below to ensure that the system and its environment are safely and appropriately positioned for efficient operation and service.

2.1 Precaution for Handling the System

Take the following precautions to avoid damage to the system or potential injury to you.

1. Prepare a flat, sturdy surface before removing the system from its packaging. The table or cart that will hold the system should be as close as possible to the system carton.
2. Ensure that all power switches have been turned off and all power cords disconnected to prevent personal injury and damage to the hardware.
3. Static electricity can damage electronic components of your system. Follow the guidelines below to avoid such damage:
    a. Work in a static-free environment
    b. Wear a grounded anti-static wrist strap
    c. Store uninstalled components in anti-static bags
    d. Handle circuit boards by their edges and avoid touching chips and connectors

2.2 Choosing the Location for the System

The ExaSAN A16S3-PS is designed as a rackmount solution. Depending on where your desk or rackmount cabinet or other install location is, you should keep the following points in mind when determining where to place your system.

1. Measure the amount of available space on your desk. The amount of space required for the A16S3-PS is L: 567mm, W:441mm, H: 131mm
2. Measure the distance between any two components that need to be connected via cable(s). This measurement will help you determine the length of the required cable(s). Or if you've already purchased the cables, determine the proximity of the components in question.
3. Leave sufficient room, at least two inches, around the unit to allow air ventilation.
4. Do not block or cover any of the ventilation holes in the front and back panels of the unit. Consistent airflow is essential to keeping the system operating efficiently.
5. Allow additional room at the front and back of the unit for service.
6. The ExaSAN A16S3-PS uses several cables and cords. It's a good idea to determine how they will be arranged at the rear of the system, and where the cables will be routed to connect to the host systems and RAID disk systems.

2.3 Electrical Power

At your chosen location for the ExaSAN A16S3-PS, make sure that the electrical circuitry and power outlets are sufficient for the combined power needs of all hardware components. To plan for safe and adequate power to the system, follow these guidelines:

1. Check the documentation for all hardware components at the chosen location to determine their power requirements. Then make sure that the available power supply for that location is sufficient for the planned components.
2. When possible use surge protectors or power conditions as part of the installation.

3. When planning for electrical power, make sure you have more power than the total power requirements specified for all components. Also make certain that the power load is distributed evenly among circuits to that location. Consult an electrician or other expert if you need assistance with planning for the power needs for your components.
4. Make sure that the power outlets for all hardware components are grounded according to local and national standards. Consult an electrician if you need assistance with grounding.

2.4 Operating Environment

The operating environment for the ExaSAN A16S3-PS must meet certain requirements:

1. Verify that the temperature range of the chosen location is within the limits established for the system and all other components.
2. Make certain that the chosen location has adequate ventilation to maintain the necessary temperature range.
3. If there are multiple hardware components installed at the chosen location, consider additional cooling measures to assure efficient operation of the system and other components.
4. Environment parameters:
    a. Operating temperature: 0°C to 40°C (32°F to 104°F)
    b. Operating humidity: 5-85%, non-condensing
    c. Storage humidity:5%-95%, non-condensing

2.5 Security

To ensure the security of the ExaSAN A16S3-PS, make certain that the chosen location meets your security requirements.

3. Installing the ExaSAN A16S3-PS

3. Installing the ExaSAN A16S3-PS

Follow the steps in this chapter to prepare your ExaSAN A16S3-PS system for installation.

3.1 Installing the System

Follow the instructions in this section to hook up all your hardware components of the ExaSAN A16S3-PS system. Do not turn the power of any individual component on until instructed. When all components are properly connected, follow the instructions in section 3.3.1 “Powering On” to turn the components on in the prescribed order.

3.1.1 Installing Disk Drives

Follow the steps below to install your HDDs. .

1. Place the HDD with connector align with the edge of the disk tray.
2. Secure HDD with screws as below figure.

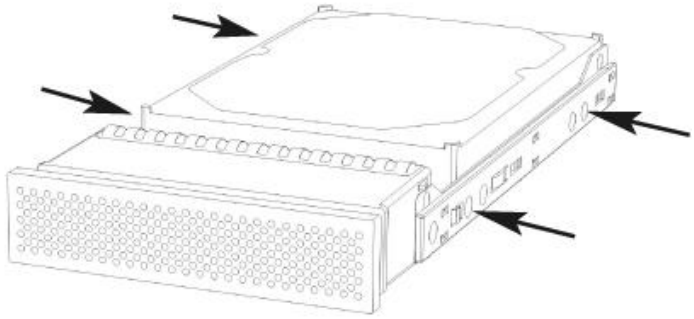


Figure10: Four screws for 3.5” HDD

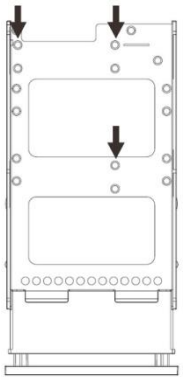


Figure 11: Three screws for 2.5” HDD

3. Slide the disk tray into the disk bays on the back of the chassis.

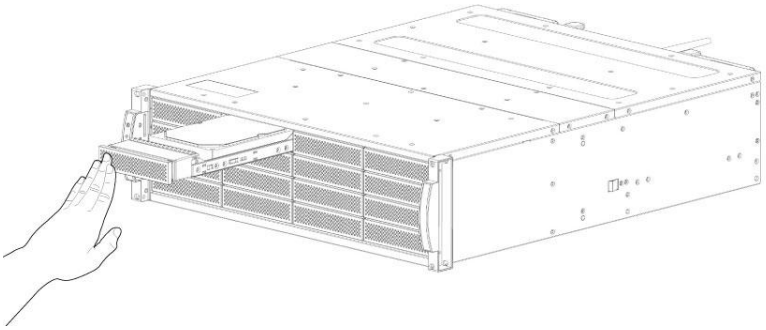


Figure 32: Insert tray into A16S3-PS

4. Push the tray inward until the tray firmly connects and you hear the tray click into place.
5. Repeat for all drives to be installed into the A16S3-PS.

Note
The hard drives in a RAID system should match in size and speed. All drives in an array should be identical models with the same firmware version.

3.1.2 Installing the HBA Card

Before the ExaSAN A16S3-PS is ready to be connected and powered on, you must install the HBA card in the workgroup client system. The HBA card is compatible with PCIe x8, and x16 slots. If a choice is given, use the fastest PCIe slot available. Although the HBA card is compatible with both PCIe 2.0 and 3.0 standards, only the latter is recommended for best performance.

Caution
PCIe slots on some motherboards are for graphics cards only. Check with the motherboard vendor for compatibility.

Follow these steps to install the card in each host system:

1. Make sure that the client system is turned off.
2. Open the client system's outer casing cover, check with your vendor documentation for instructions if necessary.
3. There are DAS and SAN ports on the Z2M HBA.
   - DAS port: Enable for DAS (Direct-Attached Storage) mode.
   - SAN port: Enable for SAN (Storage-Attached Network) mode, support to ExaSAN switch.

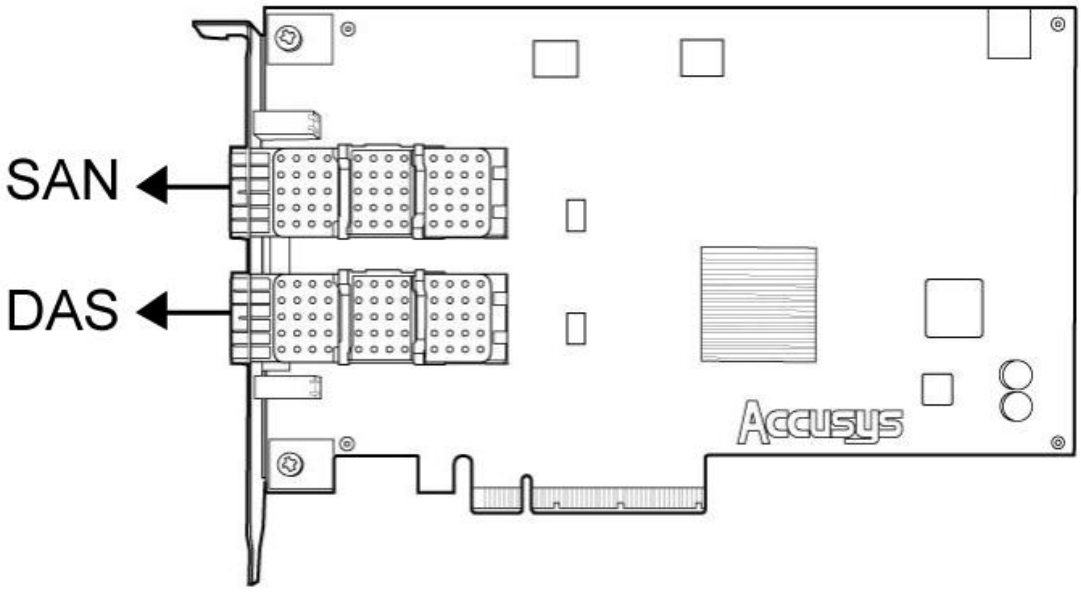


Figure 13: Z2M dual port card

4. Locate the available PCIe slot; remove the blank plate if one is present, save the screw for later use.

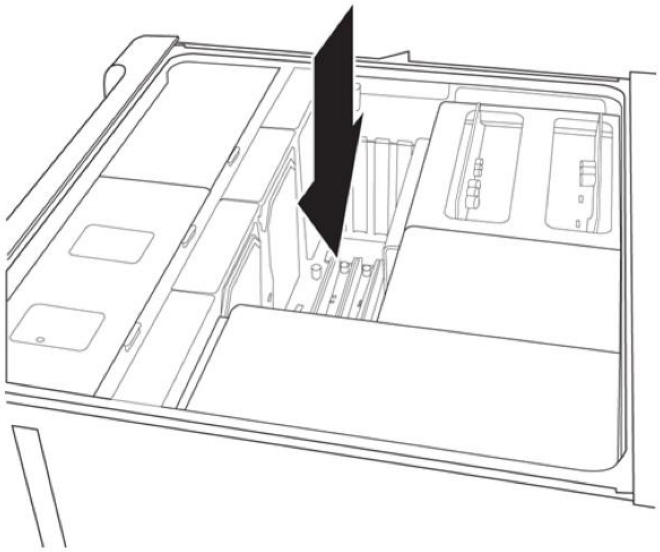


Figure 44: Install HBA card

5. Position the connector of the card over the slot, insert the connector into the slot, press gently but firmly until it is securely seated.

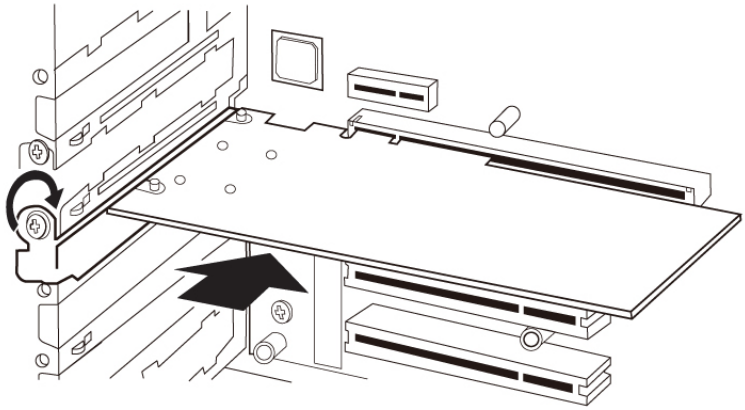


Figure 55: Install HBA card on a PCIe slot

6. Use the screw that you saved in step 2 to secure the metal bracket of the card to the system case.
7. Put back the outer casing cover and you are done.

3.1.3 Connecting cable to A16S3-PS

1. Connect A16S3-PS with a QSFP PCIe cable with the correct way (pulling ring on top), shown as below figure.

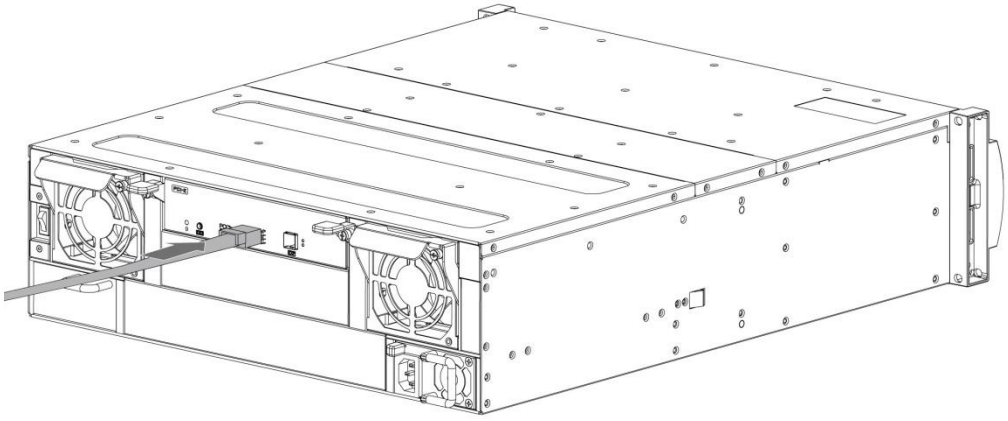


Figure 66: Connecting PCIe cable to A16S3-PS

> **Caution**
> Once powered on, Do **NOT** remove the QSFP PCIe cable when in use to avoid data loss and corruption.

2. Insert the other end of the cable to DAS port of Z2M, or to the storage port of switch.
   Refer to Z2M-G3 document on website (http://www.accusys.com.tw/products/accessories/hba-cable/document.html) for more detail.

3. Plug a power cord into the AC power-in port in the storage system; do not turn power on yet.

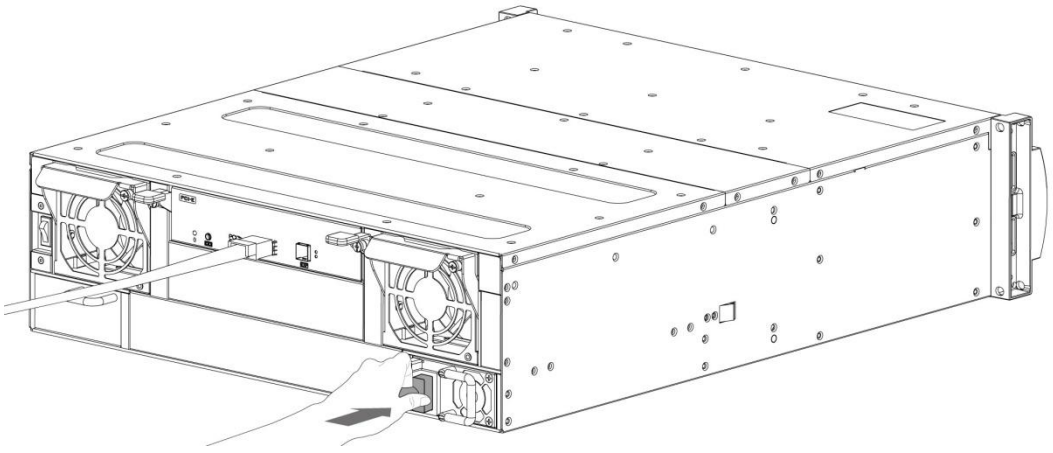


Figure 17: Connecting the power cord to A16S3-PS

3.2 Powering the System On and Off

3.2.1 Powering On

Before powering on, make sure that all cables and cords are properly installed and connected.

1. Turn on ExaSAN A16S3 by switching on the Power button. Note that you might hear a short beep when boot up. If interested, go to Sec 1.4.1.2 for beeper codes.
2. Turn on the host workstation/server.

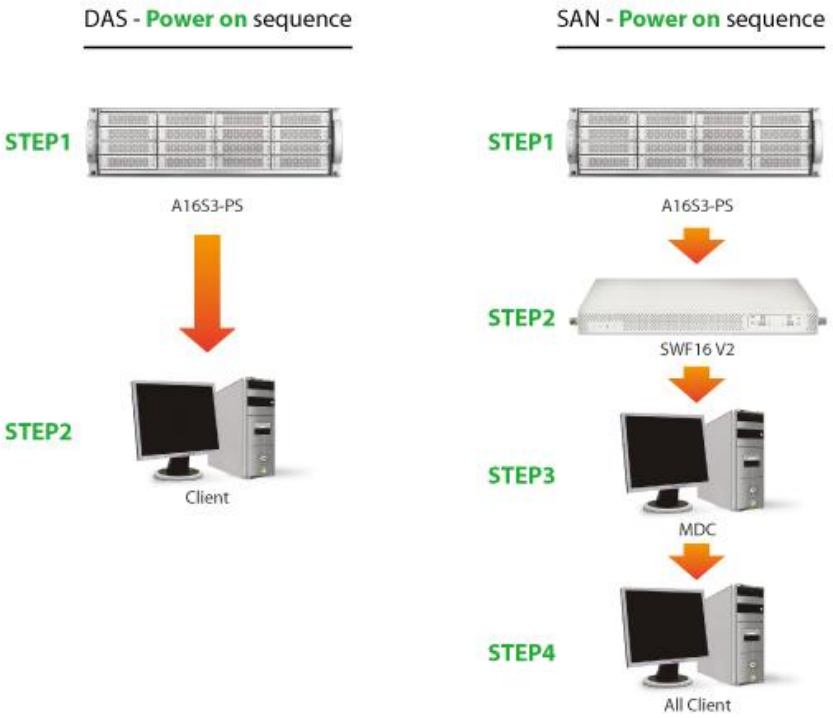


Figure 18: power on sequence

Caution
It is important to follow the correct Power On sequence, wrong steps may lead to RAID cannot be recognized by host.

3.2.2 Powering Off

If you need to power off the entire system, such as in the cases of switch or RAID system firmware updates, adding a RAID system or client computer, power off in the reverse order of Powering On, shown as below figures.

During RAID initiation or disk drive rebuilding, you can turn off the host server and leave the A16S3-PS powered on.

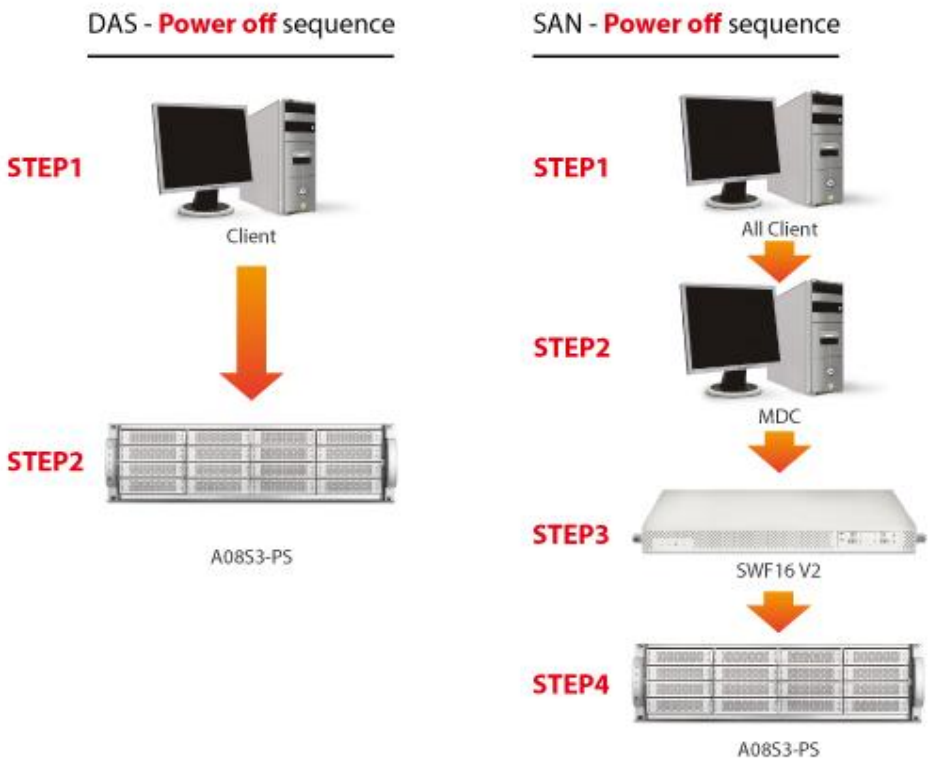


Figure 19: power off sequence

3.3 Install driver and GUI

3.3.1 Before You Start

Before installing driver and GUI, make sure you have completed the following:

- Install hard disk drives into the chassis. Please refer to Section 3.1.1, “Installing Disk Drives”.
- Install the RAID host bus adapter card to your host server. Please refer to Section 3.1.2, “Installing HBA Card”.
- Connect the QSFP cable between the A16S3-PS and the host server. Please refer to Section 3.1.3, “Connecting cable to A16S3-PS”.
- Power on the A16S3-PS and the host server in the correct sequence. Please refer to Section 3.2.1, “Powering On”.

3.3.2 Installing ExaSAN driver and GUI RAIDGuard X

Installation files can be found in DVD of accessory, you can also download the latest version from our website if necessary, check the website if any new version (http://www.accusys.com.tw/support/download.html). If you need more info or tech support, please contact reseller of ExaSAN product or Accusys FAE Dept. (see Appendix C “Customer Service and Technical Support” for more information)

Note

- For Mac/Windows platform:
  Executing installer package to install driver and GUI at the same time.

- For Linux platform:
  Driver and GUI must be built in kernel and executed separately.

3.3.2.1 Installing driver and GUI on MAC and Windows

Driver and GUI Installation

1. Insert the DVD into the DVD-ROM of the MAC or Windows.
2. For Mac, execute double clicking “/MAC Installer/Vx.x/Accusys_IP_MAC3.1.8.mpkg".
   For Windows, execute “/Windows installer/Vx.x/Accusys_Win_x.x.exe”.
   Follow the onscreen instructions to install and click **Restart** to complete installation.

Figure 20: GUI installation successful page

3.3.2.2 Installing driver and GUI on Linux

Following procedures contain 2 procedures;

- Driver installation
- GUI RAIDGuardX installation

Driver Installation

You must have your Linux system with developmental environment and kernel source, in other words you should select the adequate packages on the menu list during installation. Check “Development Tools” Then click “Optional Packages” to select all packages when you install your Linux OS.

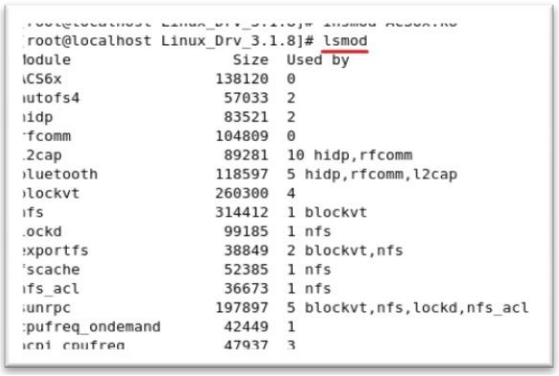
1. Copy the ExaSAN RAID system driver files onto your desktop. Open a terminal window and type the following commands to change the source files directory.

   # cd 'root/Desktop/Linux_Drv_x.x.x
   # make
   # ls

```
[root@localhost Linux_Drv_3.1.8]# ls
ACS6x.ko      acs_ame.h  ame.h         AME_Queue.c  AME_Raid.o      MPIO.c
ACS6x.mod.c   acs_ame.o  AME_import.h  AME_Queue.h  built-in.o      MPIO.h
ACS6x.mod.o   ACS_MSG.c  AME_module.c  AME_Queue.o  Makefile        MPIO.o
ACS6x.o       ACS_MSG.h  AME_module.h  AME_Raid.c   Module.markers  OS_Define.h
acs_ame.c     ACS_MSG.o  AME_module.o  AME_Raid.h   Module.symvers
```

   Verify that driver ACS6x.ko has been compiled. If so, please type the following command to install it.

   # insmod ACS6x.ko
   # lsmod



The driver (ACS6x) should be now loaded in Linux driver module list.

Note:

1. Login as **root**, install driver will need root permission.
2. If you want to **start the driver automatically**, please put the compiled driver (ACS6x.ko) to directory as follows:

   #cp ACS6x.ko /lib/modules/ "uname –r"/kernel/drivers/scsi

   [For RHEL, CentOS, etc]
   #depmod –a

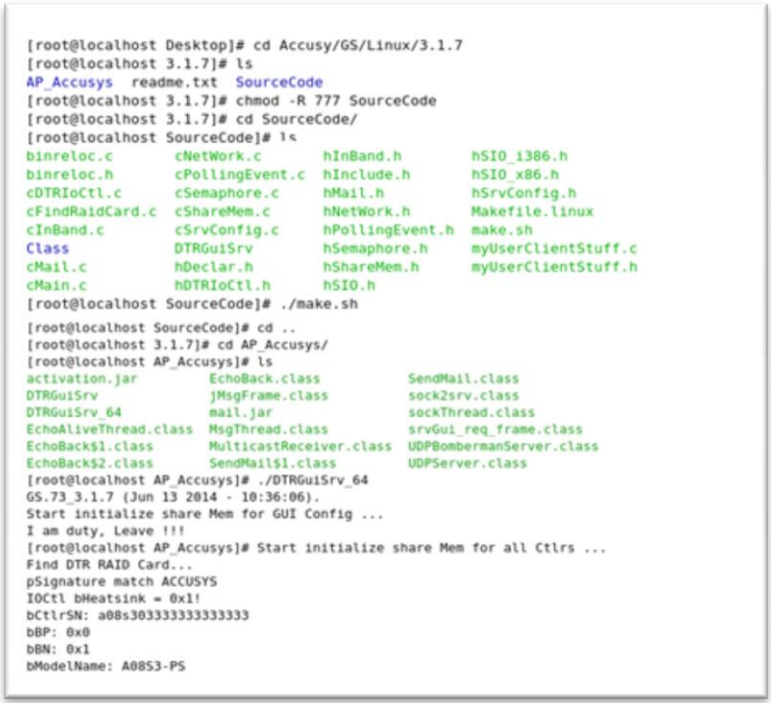
   [For SLES OS]
   #vi /etc/modprobe.d/unsupported-modules
   (Modify the line "allow_unsupported_modules 1")
   #mkinitrd
   (**Warning:** recommend to backup /boot/initrd-`uname -r` before doing "mkinitrd", if any trouble)
   #reboot

GUI RAIDGuardX Installation

Before installing RAIDGuard X, make sure the RAID HBA drivers is already installed in your Linux OS.

1. You will need two source files; GS (RAIDGuardX Server) and GC (RAIDGuardX Client), you can download from Accusys website: http://www.accusys.com.tw/support/download.html.
   GS location: /{ExaSAN model}/GUI/Server/Linux.zip
   GC location: /{ExaSAN model}/GUI/Client/x.x.x.zip
2. Create folder "Accusys", and unzip GS/GC files to subfolder GS and GC.
3. Perform GS, open a terminal console, and enter the following commands:

   # cd /Accusys/GS/Linux/X.X.X
   # chmod -R 777 SourceCode
   # cd /Accusys/GS/Linux/X.X.X/SourceCode/
   # ./make.sh
   # cd /Accusys/GS/Linux/X.X.X/AP_Accusys/
   # ./DTRGuiSrv_64



Note: Leave the GS terminal there and **DON'T** close it. Open another new terminal to perform GC.

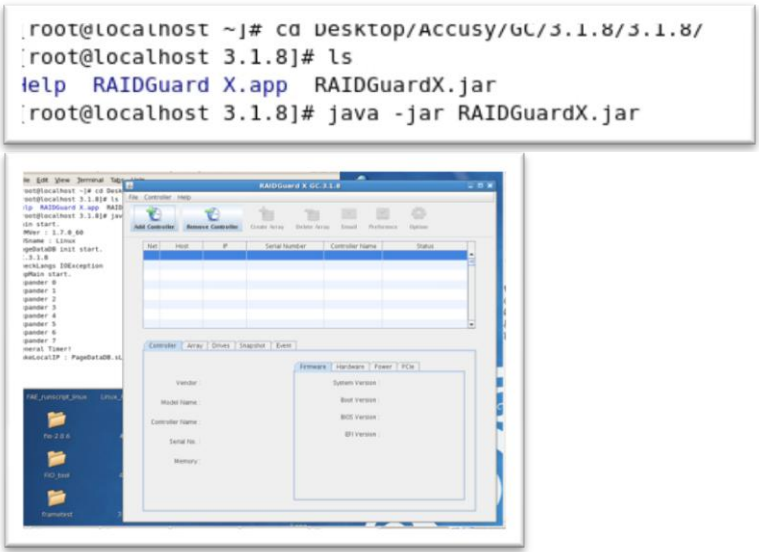
4. Perform GC, first to make sure the Java version is higher than 1.6, enter the following commands:

   # java –version

[root@localhost ~]# java -version
java version "1.6.0_14"
Java(TM) SE Runtime Environment (build 1.6.0_14-b08)
Java HotSpot(TM) Client VM (build 14.0-b16, mixed mode, sharing)
[root@localhost ~]#

If your Java version is earlier than 1.6, please go to www.java.com to upgrade. If version is ok, please enter the following commands:

 # cd /Accusys/GC/x.x.x./x.x.x/
 # java –jar RAIDGuardX.jar


root@localhost ~]# cd Desktop/Accusy/GC/3.1.8/3.1.8/
root@localhost 3.1.8]# ls
lelp RAIDGuard X.app RAIDGuardX.jar
root@localhost 3.1.8]# java -jar RAIDGuardX.jar

Now you can add controller to config and manage ExaSAN system.

3.3.3 Confirm the ExaSAN RAID system driver on OS

3.3.3.1 Confirming the ExaSAN RAID system driver on Mac

After installing the ExaSAN RAID system HBA driver on the Mac host server, confirm the driver has been properly installed with the following steps.

1. Click **About This Mac** in menu bar
2.

Figure 71: to click about This MAC

3. Click the **More Info…** button.

About This Mac
OS X
Version 10.9.1
Software Update...
Processor 2 x 2.8 GHz Quad-Core Intel Xeon
Memory 8 GB 667 MHz DDR2 FB-DIMM
Startup Disk 10.9GM
More Info...
TM and © 1983-2013 Apple Inc.
All Rights Reserved. License Agreement

Figure 22: About This MAC

4. Click on the **System Report…** button.

About This Mac
Overview Displays Storage Memory
Support Service
Mac Pro
Early 2008
Processor 2 x 2.8 GHz Quad-Core Intel Xeon
Memory 8 GB 667 MHz DDR2 FB-DIMM
Graphics ATI Radeon HD 2600 XT 256 MB
Serial Number G88016AEXYK
Software OS X 10.9.1 (13B27)
System Report...
Software Update...

Figure 23: more info About this MAC

In **Hardware** category, click on **PCI Cards**. If the driver has been correctly installed, the HBA is listed with the **ACS6x** identifier (actual name may vary) as a **RAID controller**. If you do not see the HBA listed here, power off the host server, reseat the card, and reinstall the driver..

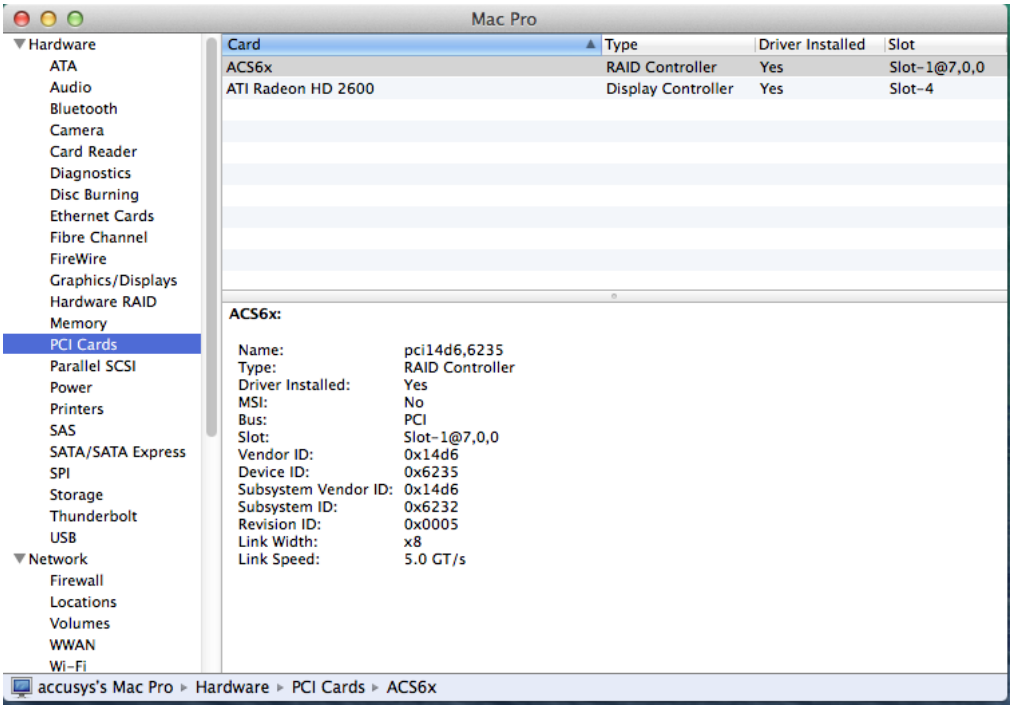


Figure 24: MAC Pro info

3.3.3.2 Confirming the ExaSAN RAID system driver in Windows

After installing the ExaSAN RAID system HBA driver on a Windows based host server, confirm the driver has been properly installed.

Go to **Control Panel -> System Properties -> Hardware -> Device Manager** (depending on the version of Windows, the path may vary). If the driver has been correctly installed, the HBA is listed with the **ACS6x** identifier (actual name may vary) as **Storage Controllers**.

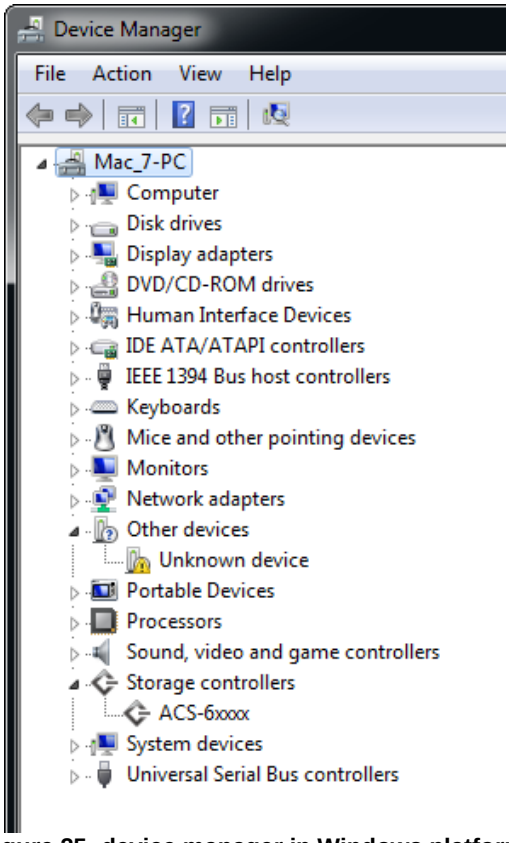


Figure 25: device manager in Windows platform

Caution
If you see the HBA listed as an unknown device under Windows, follow the driver installation steps to reinstall the driver. If you do not see the HBA under Device Manager, Windows does not detect the card. Power off the host server to reseat the HBA.

3.3.4 Confirm LEDs on HBA

Verify the Link and Access LED on the backplane of the HBA are appropriately lit according to your installation (Refer to Section 1.5.2 ExaSAN QSFP Host Bus Adapter). Onboard LEDs of Z2M indicate more link status, please refer to the Appendix A FAQ Q3.

4. Using RAIDGuard X

4. Using RAIDGuardX GUI

4.1 RAIDGuard X Overview

RAIDGuard X is a powerful GUI management tool, which support local and remote monitoring of multiple controllers that are connected to the same network. RAIDGuardX have to work with 2 components: RAIDGuardX-Server and RAIDGuardX-Client.

RAIDGuardX-Server: Communicates with RAIDGuardX-Client and RAID controller, it MUST be installed on which host directly connected to RAID system.

RAIDGuardX-Client: A java based console to manage and monitor RAID system, which MUST works with RAIDGuardX-Server via local server or network remotely.

4.1.1 Key Features

- Easily manage and morning by Java Based GUI
- Support multiple RAID system
- Multi-platform and operating system
- Remote monitoring
- Event notification

After you have connected all your ExaSAN components, powered the system on, and installed the RAIDGuardX drivers, we will first need to perform some basic configuration and setup before the ExaSAN RAID system is fully operational.

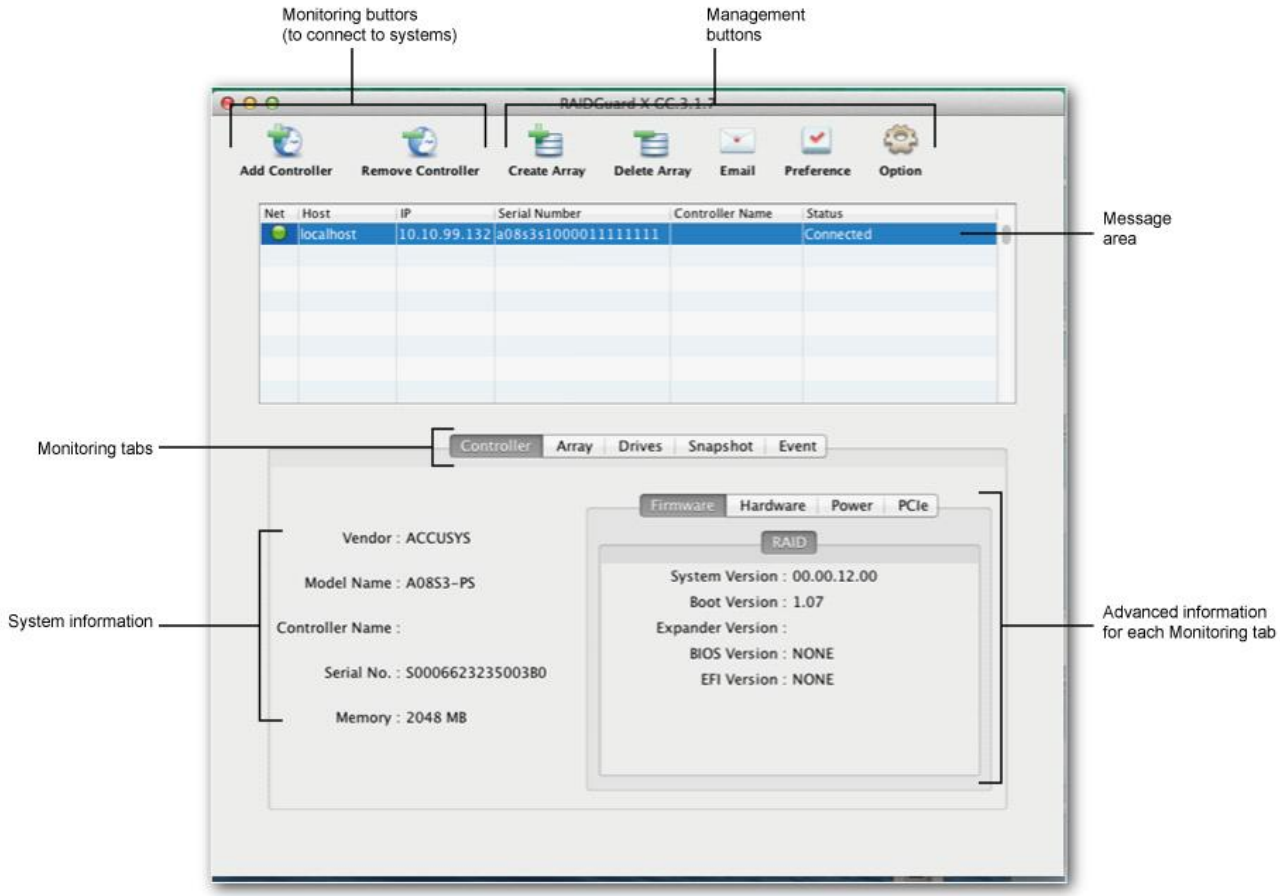


Figure 26: GUI "Main screen"

	Function		Description
1	Add Controller		Add RAID controller/system to RAIDGuard X
	Remove Controller		Remove RAID controller/system from RAIDGuard X
2	Create Array		Create an array from disk drives in the storage system
	Delete Array		Delete an array in the storage system
3	Email		Set email notification
4	Preference	Drive Lag Proof	Enable/ Disable Drive Lag Proof
		NCQ Mode	Enable/ Disable NCQ mode
		SMART Mode	Enable/ Disable SMART Mode
		Beeper	Enable/ Disable Beeper
		Equalization Mode	Enable/ Disable Equalization
5	Option	Slicing	Divide an existing array into multiple slices.

		LUN Map	Map volumes of slices to the LUN of the host
		Expansion	Increase total capacity of an array by adding spare drives
		Migration	Migrate current RAID level to a selected RAID level
		Snapshot	Create mirror(s) of existing volumes of array for backup
		Health Center	Repair and maintain arrays
		Unlock Drives	Change the locked drive(s) status

4.2 Accessing the RAIDGuardX GUI

4.2.1 RAIDGuard X Client and Server

This chapter details the usage of the RAIDGuard X Client/Server. Before you can access the RAID controller, you must load the RAIDGuard X Server on the host server.

RAIDGuard X Client

When installing RAIDGuard X, the software and drivers are automatically installed in your Host. The RAIDGuard X interface will display RAID systems connected to the Host via PCIe cable.

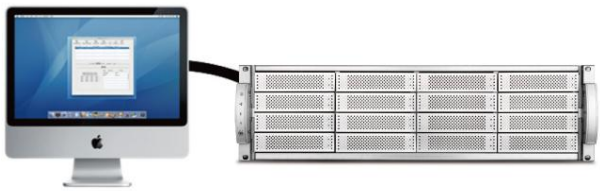


Figure 8: GUI "MAC OS X platform"

To access RAIDGuard X Client:

For Macs: Go -> Application -> RAIDGuard X -> RAIDGuard X Client
For Windows: Start -> Program -> Accusys -> RAIDGuard X -> RAIDGuard X Client

RAIDGuard X Server

RAIDGuard X can provide remote configuring and monitoring features. A host with RAIDGuard X Server installed can use RAIDGuard X to identify Accusys RAID systems on the same network, regardless if it is DAS or SAN. RAIDGuard X enables one server to configure multiple RAID systems, but you can only configure one RAID system at a time. To configure another RAID system, you must log out and then select another system.

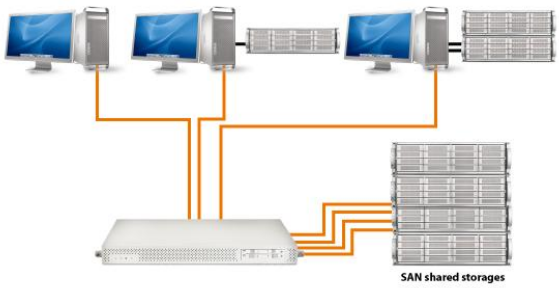


Figure 28: GUI "SAN environment"

RAIDGuard X Server runs constantly in the background on the host system.
To access RAIDGuard X:

For Macs: Go -> Application -> RAIDGuard X -> RAIDGuard X
For Windows: Start -> Program -> Accusys -> RAIDGuard X -> RAIDGuard X

4.2.2 RAIDGuard X Menu Bar

The menu bar across the top contains the following functions:

File –
Exit – Close the program.
Load Controller List – Refresh the controller list.
Language – English and Japanese are supported.

Controller –
Manual Add Controller – Manually search and add the controller. Refer to Section 4.1.2.1 Adding and Removing Controllers.
Update –
Update System Code – Click to update the firmware of the controller.
Update Boot Code – Click to update the boot code of the controller.

Dump controller log – Download the events log stored in the flash memory of the RAID controller. The log is useful for Accusys Support team take troubleshooting.

Note
These events are automatically saved as a zip file,
1. MacOS: save in /Applications/RAIDGuard X/Log.
2. Windows: save in /program file/accusys/exasan/log
3. Linux: save in /{RAIDGuard X install folder}/log

Please send the log file to your vendor or Accusys tech support team to analyze. support@accusys.com.tw

Help –
Search – Search keyword in RAIDGuard X.
Help Center – Displays the help for RAIDGuard X.

4.2.2.1 Adding and Removing Controllers

In order to administer a controller, it first needs to be added to the network. Once added, the administrator is given full control over the controller.

RAIDGuard X is a powerful GUI management system. It can be used for remotely monitoring the RAID controller. If using the server to administer RAID configurations, you must make sure that the RAID host and server are on the same network. The direct attached storage client can also add or remove controllers in RAIDGuard X.

Adding

1. Click **Add Controller** to display a list of available controllers on the network. If the ExaSAN RAID system is used as a DAS, the controller is displayed as “Local” under the IP field.
2. Click on the controller to administer, enter the password. The default password for the Accusys PCIe controllers is 00000000 (8 zeros).
3. Assign a name to the controller and click **Add**.

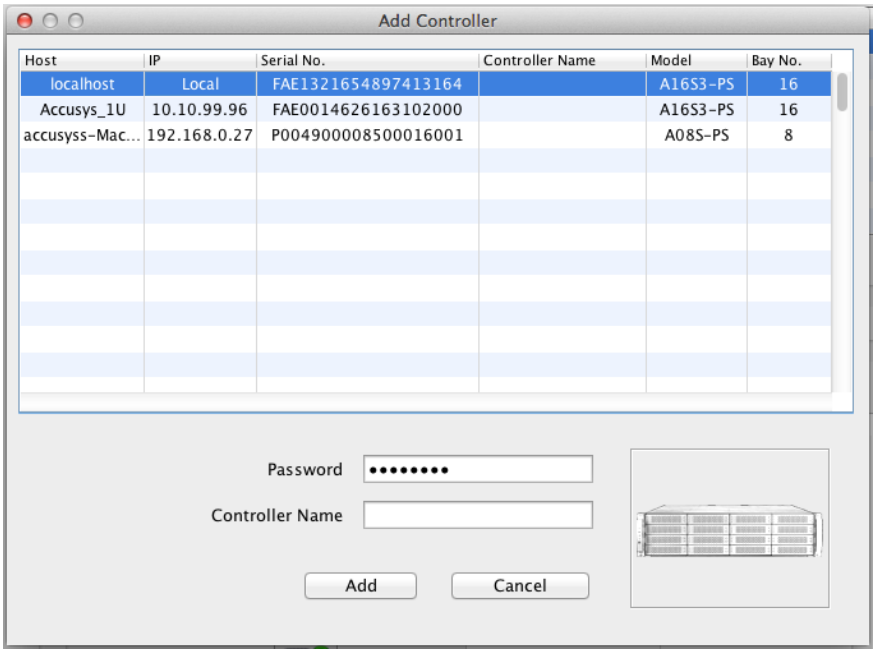


Figure 29: GUI “Add RAID controller”

4. The Main screen lists the controller after it has been successfully added.

> **Note**
> To change the controller password, refer to Section 4.1.2.7.3 MISC.

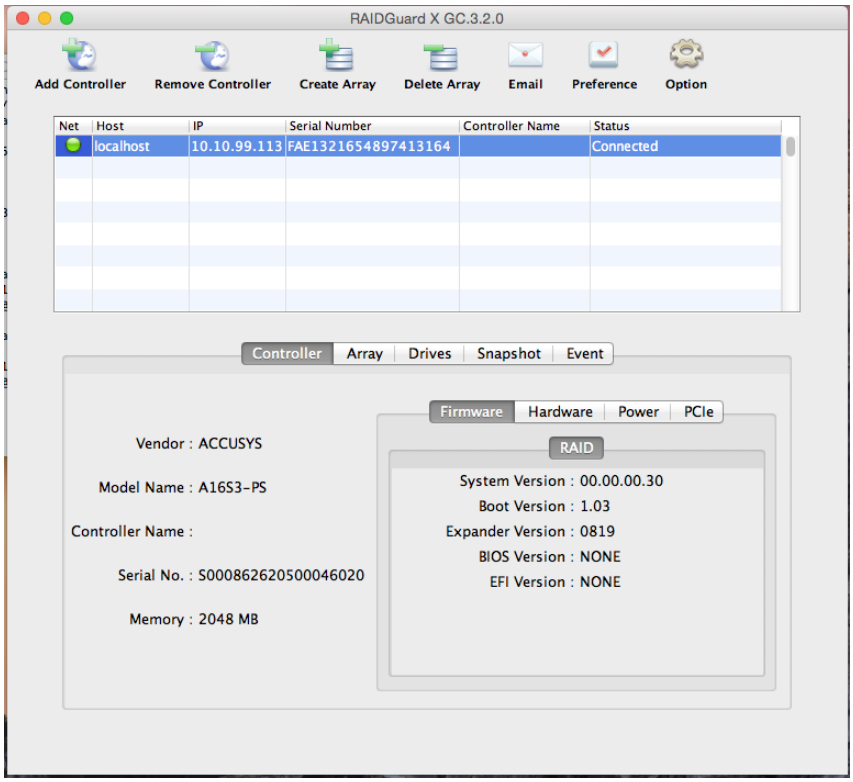


Figure 90: GUI "RAID controller info"

Manual Add Controller

In the event that a SAN connection, firewall is used or special network settings are in place, RAIDGuard X client may not be able to detect the Server in the Main Menu. In this case, you can manually add another controller in the network.

1. Click on Controller on the menu bar and select **Manual Add controller**.

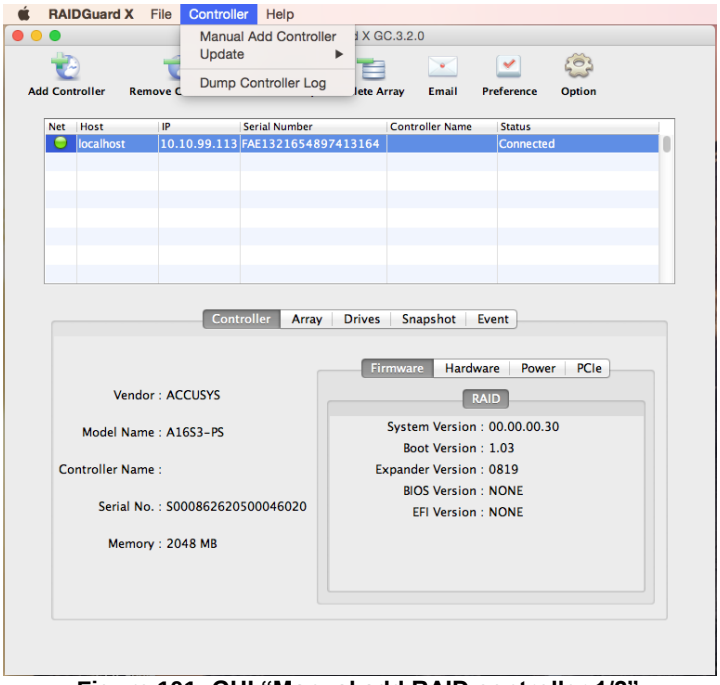


Figure 101: GUI "Manual add RAID controller 1/2"

2. Enter the Server or Switch IP.

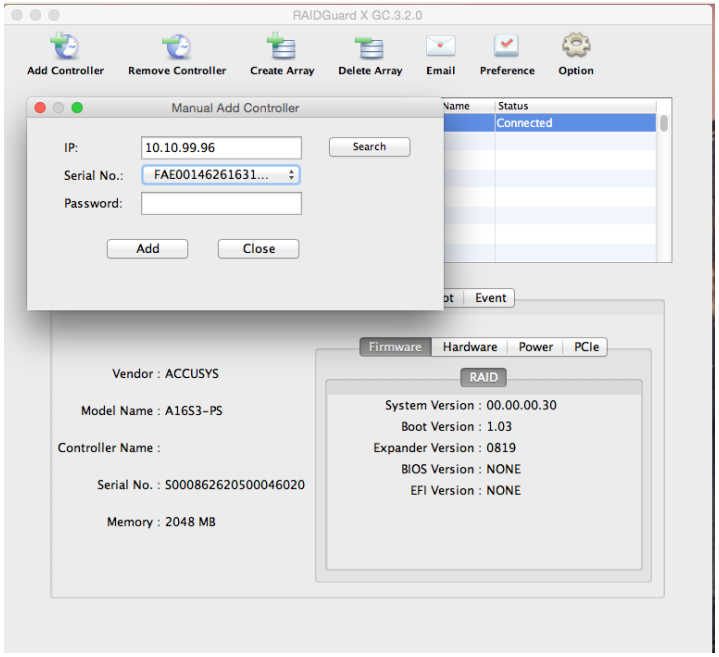


Figure 32: GUI "Manual add RAID controller 2/2"

3. Click **Search** and wait for the Serial Number to populate.
4. Type the password (default is 00000000) for the controller.
5. Click **Add** to finish adding the controller.

Removing

To remove a controller, select a controller and then click the **Remove Controller** button to remove the controller from the table. When the popup window appears, select **Yes**.

4.2.2.2 Planning your RAID

Before using RAIDGuard X to set up your RAID storage, it is a good idea to become familiar with the variety of configurations, or schemes, that are available for the ExaSAN RAID storage. This section describes these schemes and illustrates how each RAID level is applied.

RAID Level	Description	Capacity
RAID 0	Striping, the fastest and most efficient array type but offers no fault-tolerance	Total of all drives
RAID 1	Mirroring, All disks have the same data	Total of one drive
RAID 5	Block-level striping with distributed parity, one disk fault tolerant	Total of all drives minus one drive
RAID 6	Block-level striping with double distributed parity, two disks fault tolerant	Total of all drives minus two drives
RAID 0+1	Combines the advantage of R0 and R1, provides optimal speed and reliability	One-half the total capacity of drives (Sum of RAID 1 member sets)

When configuring RAID, you may take the follow items into consideration:
1. Are you using a DAS or SAN environment?
2. Do you currently have more than one RAID or JBOD?
3. Which is more important, transfer speed or data security? One or two disk fault tolerance?
4. Do you need multiple volume or single volume on your RAID systems?
5. Do you have to consider the metadata volume for SAN software?
6. Do you consider using Global spare drives?
7. The number of disk drives used determines the speed of the RAID created. Take into account the desired speed when configuring RAID.

Creating and Deleting an Array

Administrators can choose how best to distribute the available hard disk drives. Once an array has been created, it can be further administered in the **Options** section.

Creating an Array

When the RAID controller is first configured, an array needs to be set up. This array tells the controller how many disks to use and what their function should be.

Follow the steps below to create an array:

1. Select the RAID level from the drop down menu. Available levels are: 0, 1, 5, 6, 0+1 and JBOD.

> **Note**
> Each RAID level has a minimum disk requirement. This is shown in the information to the right of the drop down list. For example, RAID 5 requires at least 3 drives.

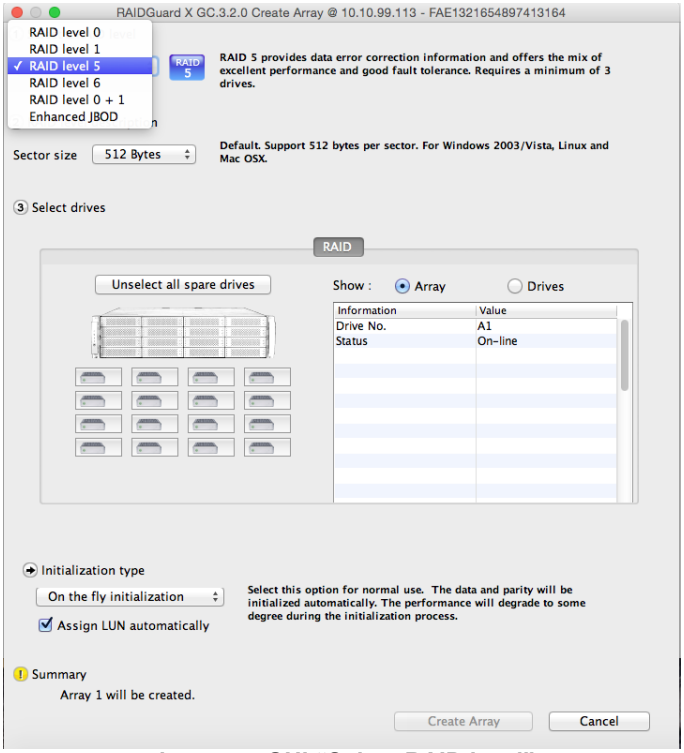

RAIDGuard X GC.3.2.0 Create Array @ 10.10.99.113 - FAE1321654897413164
RAID level 0
RAID level 1
RAID level 5
RAID level 6
RAID level 0 + 1
Enhanced JBOD
RAID 5 provides data error correction information and offers the mix of excellent performance and good fault tolerance. Requires a minimum of 3 drives.
Sector size
512 Bytes
Default. Support 512 bytes per sector. For Windows 2003/Vista, Linux and Mac OSX.
3 Select drives
RAID
Unselect all spare drives
Show :
Array
Drives
Information
Value
Drive No.
A1
Status
On-line
Initialization type
On the fly initialization
Assign LUN automatically
Select this option for normal use. The data and parity will be initialized automatically. The performance will degrade to some degree during the initialization process.
Summary
Array 1 will be created.
Create Array
Cancel

Figure 33: GUI "Select RAID level"

> **Note**
> Details on the RAID levels are in **Chapter 5 RAID Overview**.

2. Select the stripe size from the drop down menu. Available stripe sizes are: 8-256KB. The greater the stripe size, the faster the I/O output for each drive. This speeds up disk access.
3. Select the sector size from the drop down menu. Available sector sizes are 512 bytes (default) and 4096 bytes. The sector size 4096 bytes is only supported by Windows XP, and over 2 Terabyte function is used. For other OSes, please select 512 bytes (default).

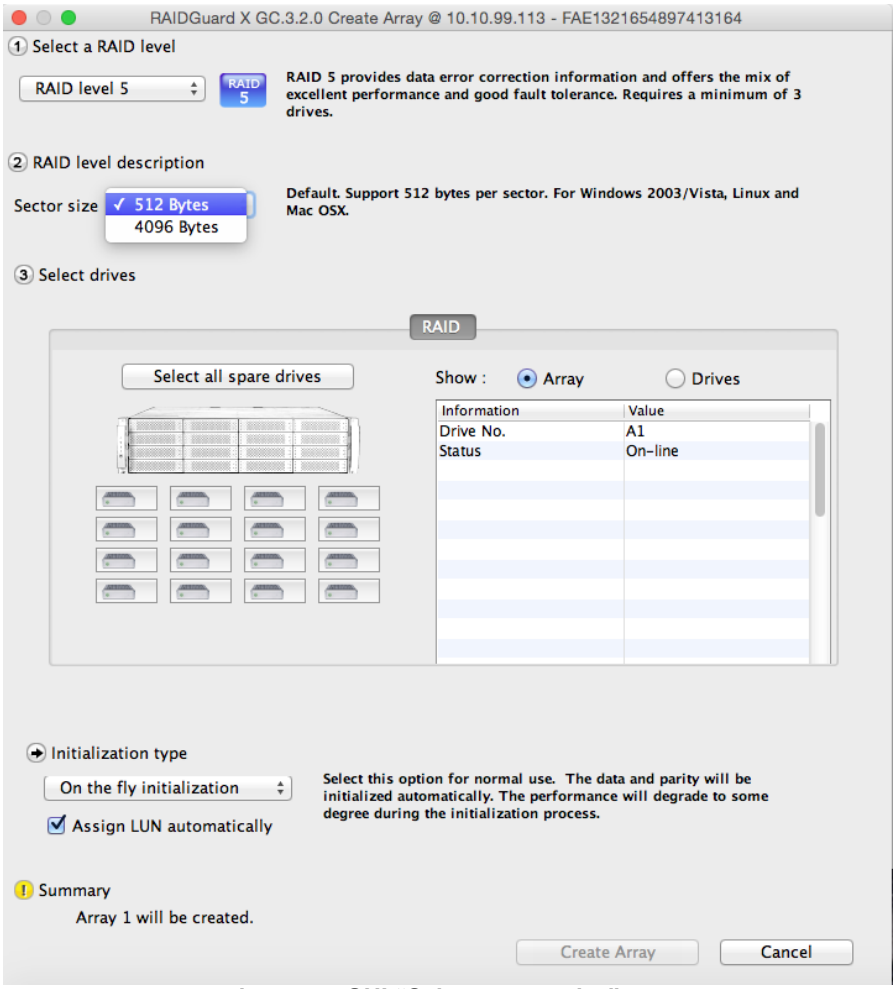

RAIDGuard X GC.3.2.0 Create Array @ 10.10.99.113 - FAE1321654897413164
1 Select a RAID level
RAID level 5
RAID 5
RAID 5 provides data error correction information and offers the mix of excellent performance and good fault tolerance. Requires a minimum of 3 drives.
2 RAID level description
Sector size
✓ 512 Bytes
4096 Bytes
Default. Support 512 bytes per sector. For Windows 2003/Vista, Linux and Mac OSX.
3 Select drives
RAID
Select all spare drives
Show :
Array
Drives
Information
Value
Drive No.
A1
Status
On-line
Initialization type
On the fly initialization
Select this option for normal use. The data and parity will be initialized automatically. The performance will degrade to some degree during the initialization process.
Assign LUN automatically
Summary
Array 1 will be created.
Create Array
Cancel

Figure 34: GUI "Select sector size"

4. Click on the drives to be added to the array. You can also click on **Select all spare drivers**.

> **Note**
> Hot (Global) spare drive – When building an array, the hard drives which are not defined will be used as spare drives for all arrays defined within the controller. If a drive(s) in use fails, a spare drive(s) will replace the faulty drive in the array and rebuild automatically. One of the advantages of adopting hot spare drive is to reduce the downtime.

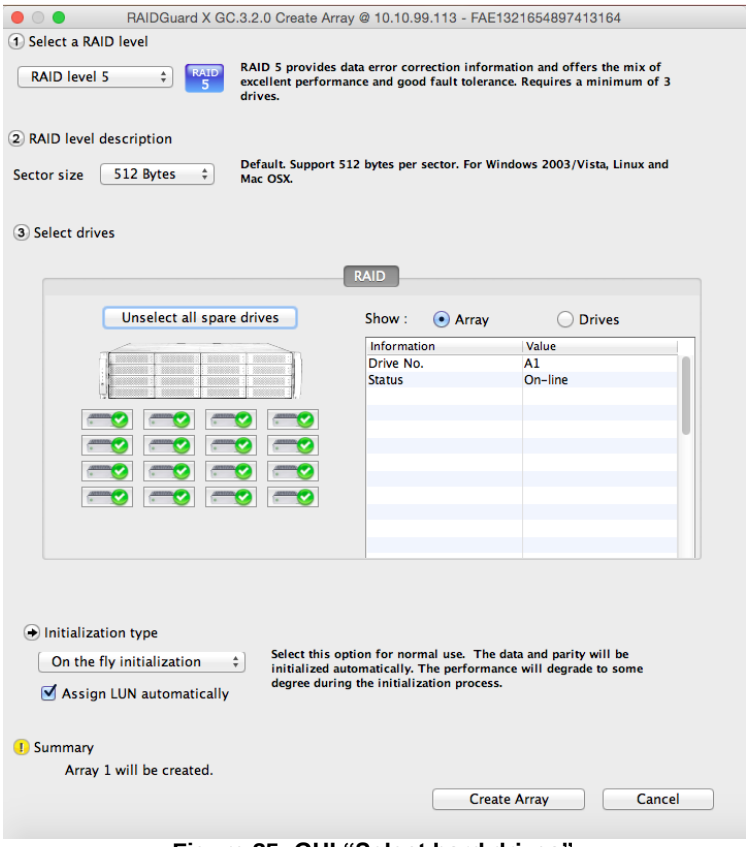

RAIDGuard X GC.3.2.0 Create Array @ 10.10.99.113 - FAE1321654897413164
1 Select a RAID level
RAID level 5
RAID 5 provides data error correction information and offers the mix of excellent performance and good fault tolerance. Requires a minimum of 3 drives.
2 RAID level description
Sector size
512 Bytes
Default. Support 512 bytes per sector. For Windows 2003/Vista, Linux and Mac OSX.
3 Select drives
RAID
Unselect all spare drives
Show :
Array
Drives
Information
Value
Drive No.
A1
Status
On-line
Initialization type
On the fly initialization
Select this option for normal use. The data and parity will be initialized automatically. The performance will degrade to some degree during the initialization process.
Assign LUN automatically
Summary
Array 1 will be created.
Create Array
Cancel

Figure 35: GUI "Select hard drives"

Optional: From the drop down menu, select either **On-the-fly initialization** or **Performance evaluation**.

On-the-fly initialization – ExaSAN RAID systems record the initialized sectors in the bitmap. All sectors are initialized only once. The entire initialization process will be completed faster and the performance will be better during the initialization.

During on-the-fly initialization, 65-75% of the full speed (of a created RAID) is still available. You can still use the RAID system during the RAID initialization.

Select this option (default) to ensure the completeness of the array. If this option is selected, it will recalculate the disk parity and data organization (how it is arranged). The amount of time required for the initialization process varies depending on the disk volume.

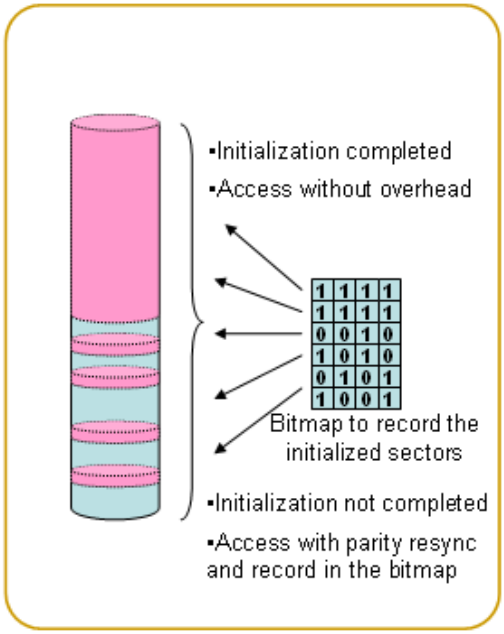

▪Initialization completed
▪Access without overhead
Bitmap to record the initialized sectors
▪Initialization not completed
▪Access with parity resync and record in the bitmap

Figure 36: parity initialize

Performance evaluation – Select to evaluate the performance of the target array. Data and parity are not initialized. (No data protection when this mode is on).

> **Note**
> Once you click **Create Array** and you have selected On-the-fly initialization, you will see the initializing % on the Main screen.
>
> You will be able to use and configure the array immediately if it is created using On-the-fly initialization. However, the RAID performance of the array will be slightly lower than usual before the initialization is complete.

Assign LUN automatically

Check this box to automatically assign a LUN. You may choose to assign LUN manually under **Options**. However, you will not be able to use the RAID volume until it has been assigned a LUN.

Click **Create Array** to complete the process.

> **Note**
> If you attempt to create a RAID set without meeting the minimum required number of hard disk drives, and error message will pop up after clicking **Create Array**.

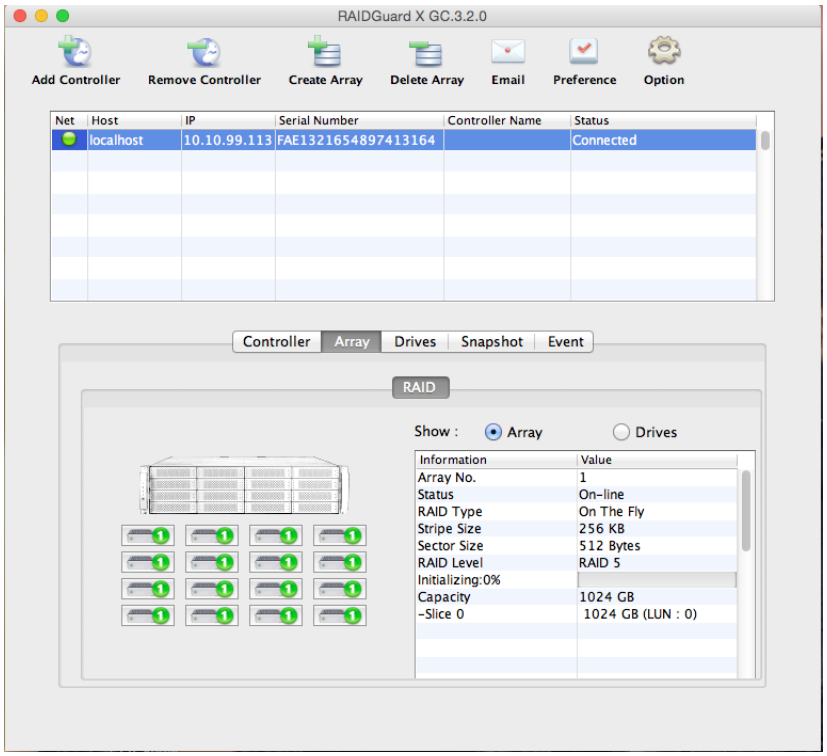


Figure 37: GUI "Array initializing percentage"

After the array has been created, the Main screen displays the newly created array with an array number. The array initialization progress is also displayed.

Arrays are assigned numbers in the order they are created. For example, the first array created is labeled with the “1” icon; the second array created is labeled with the “2” icon, and so forth.

> **Note**
> The ExaSAN RAID controller can support a maximum of 4 arrays. Once 4 arrays have been created, the **Summary** section indicates all arrays numbers are in use and you will not be allowed to create more arrays.

Delete an Array

Deleting an array removes the selected array, and allows the drives to be used in another array, or reconfigured for a new array. Follow the steps to delete an array.

1. Click on the drives containing the array to be deleted.
2. Check the **Confirm** box. Click **Delete Array** to complete the process.

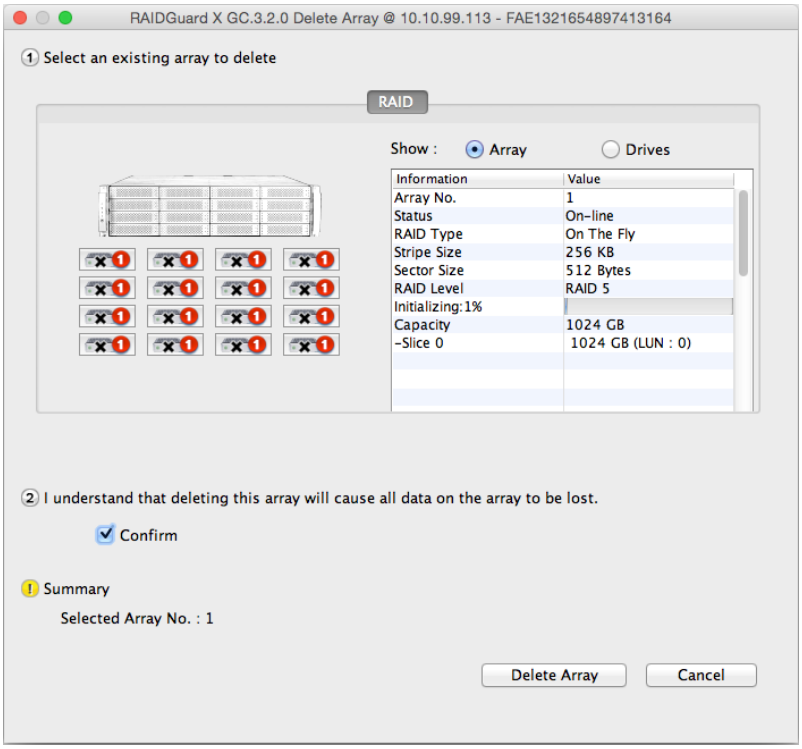

RAIDGuard X GC.3.2.0 Delete Array @ 10.10.99.113 - FAE1321654897413164
1 Select an existing array to delete
RAID
Show : Array Drives
Information Value
Array No. 1
Status On-line
RAID Type On The Fly
Stripe Size 256 KB
Sector Size 512 Bytes
RAID Level RAID 5
Initializing: 1%
Capacity 1024 GB
-Slice 0 1024 GB (LUN : 0)
2 I understand that deleting this array will cause all data on the array to be lost.
Confirm
Summary
Selected Array No. : 1
Delete Array
Cancel

Figure 38: GUI “Delete array”

> **Caution**
> When you delete an array, all data on the hard disk drives will be lost.

Controller Info

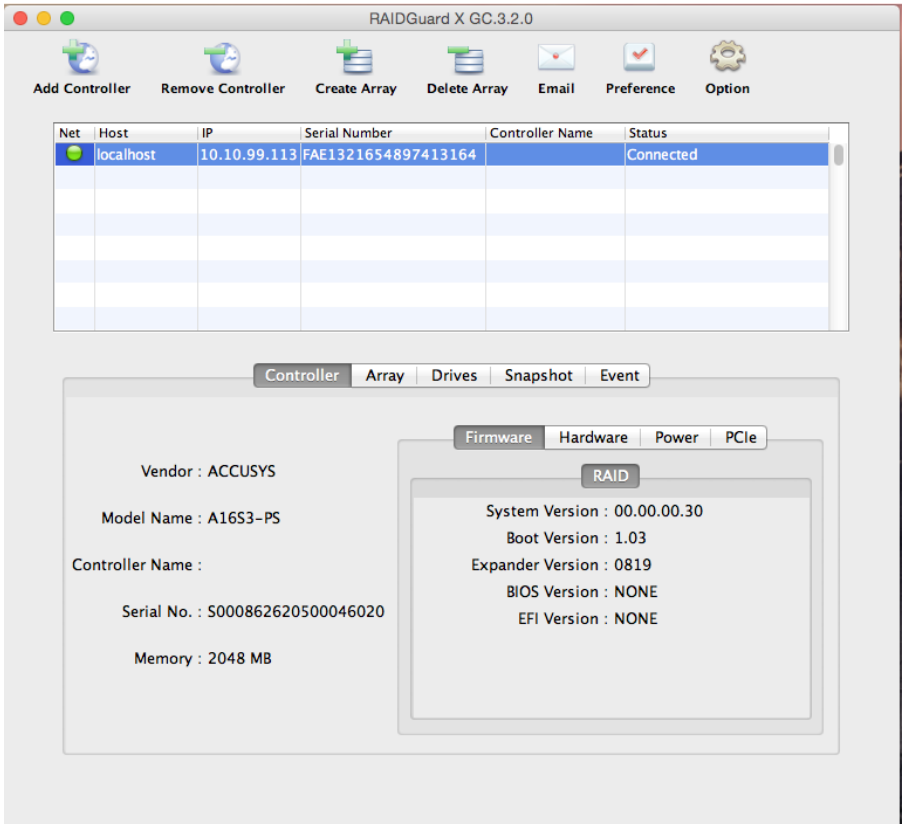
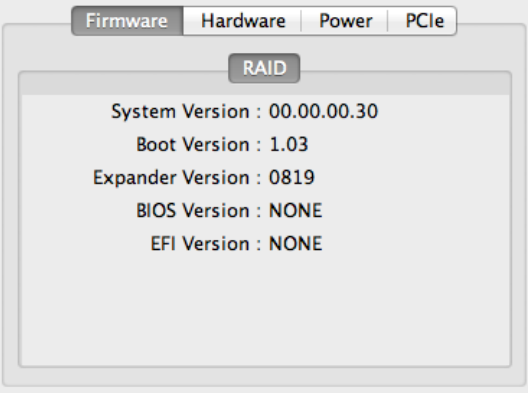


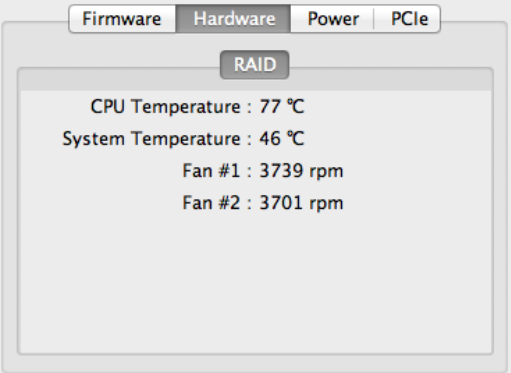
Figure 39: GUI "Controller info"

The system information section provides details on the vendor, model name, controller name, serial number, and memory size. It also has 4 tabs: **Firmware**, **Hardware**, **Power,** and **PCIe**.

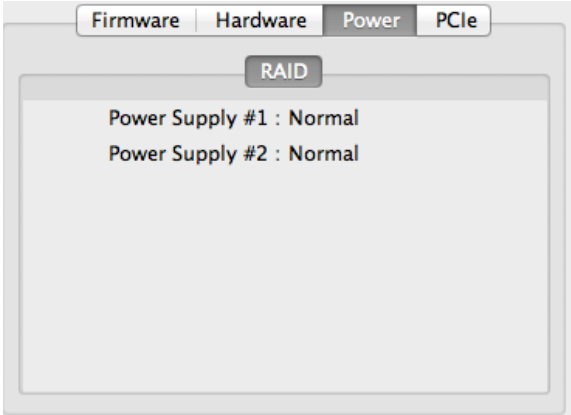
The **Firmware** tab details the system version, boot version, BIOS version and EFI version.



The **Hardware** tab details the CPU temperature, system temperature, and fan speeds.



The **Power** tab details the battery backup module status and power supply status.



The **PCIe** tab details the PCIe status.

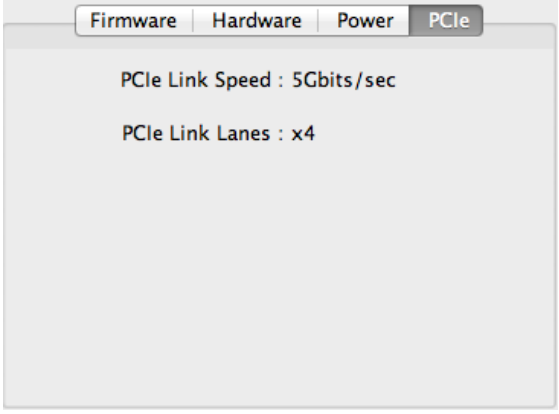


Figure 11: GUI "Controller info for four sections"

Array

The Array & Drives tab provides details on the status of the drives, such as which array they are assigned to. It also has 2 radio buttons: Array and Drives.

The icons next to each drive will change depending on whether the Accusys PCIe controller is installed. The number above the drive indicates the array number.

Figure 121: GUI "Array member"

Clicking the Array radio button displays information about the array: the array number, Status, RAID type, stripe size, sector size, RAID Level, capacity, and slice.

The status of array actions, such as initialization, migration, and expansion, can be viewed under the Array tab.

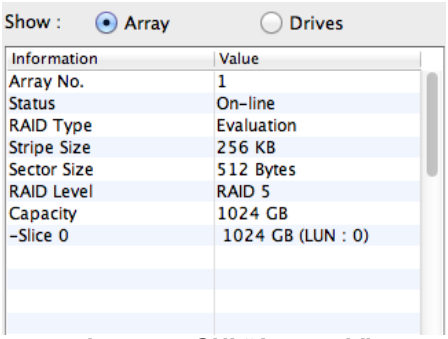


Figure 41: GUI "Array tab"

Clicking the Drives radio button displays information about individual drives. Click on each drive image to view the drive number, status (On-line or Failed), drive type (RAID or Spare), model, revision status and capacity.

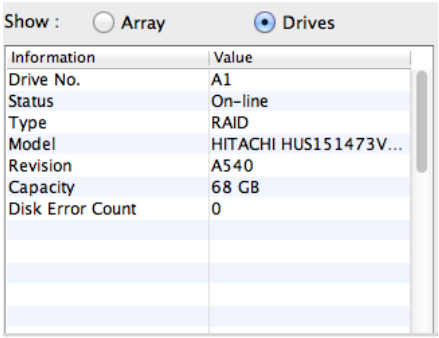


Figure 42: GUI "Drive tab"

Drives
Display the overview of all drives for the selected controller.

Snapshot
The progress of the snapshot is displayed in the snapshot tab. To enable the snapshot function, see **Options > Snapshot**.

Event
Display a list of the most recent events.

4.2.2.3 Formatting and Mounting Arrays

After creating a RAID array on the ExaSAN RAID system, the array appears as an unformatted disk to the host system. Use the host's disk management utility to format and mount the array for use.

> **Note**
> The following steps are for MAC users only. For PC users, consult with your operating systems knowledge base on using the disk management utility to format and mount arrays.

1. Restart the host system. In some instances, restarting the host system may not be necessary, but if you are creating or adding arrays, you generally must restart before the arrays are visible in Disk Utility.
2. Open Disk Utility on the host system.
3. Select the array in the list at the left side of the window.
4. Click on the **Erase** tab.
5. Choose a format for the array from the Volume Format pop-up menu.
6. Type a name for the array.
7. Click **Erase** and confirm by clicking **Erase** again. Once formatting is complete, the array mounts on the host system.
8. Repeat for each new array.

4.2.2.4 Email Notification Setting

It may be necessary for network administrators to receive e-mails in the event of errors, alerts, and changes to the RAID array. These alerts can be e-mailed to a maximum of 20 e-mail addresses.

Mailing List
Enter the e-mail address(es) of people to receive controller error reports.
Click **Remove** to delete e-mail addresses from the list.
Click **Send Test Email** to check that the e-mail is working.

SMTP Setting
Mail Server Name – Enter the address of the mail server.
From Email Address – Enter the e-mail address of the mail server.
SMTP Server – requires authentication for user name and password
Check this box if your mail server requires a user name and password.

SMTP POST event
Check this box if wish to create a log for error events.

> **Note**
> 1. Ask your systems administrator for SMTP Server details.
> 2.Not support outbound SMTP mail service, e.g. Gmail, Hotmail. Yahoo.
> Contact to tech support for more detail.

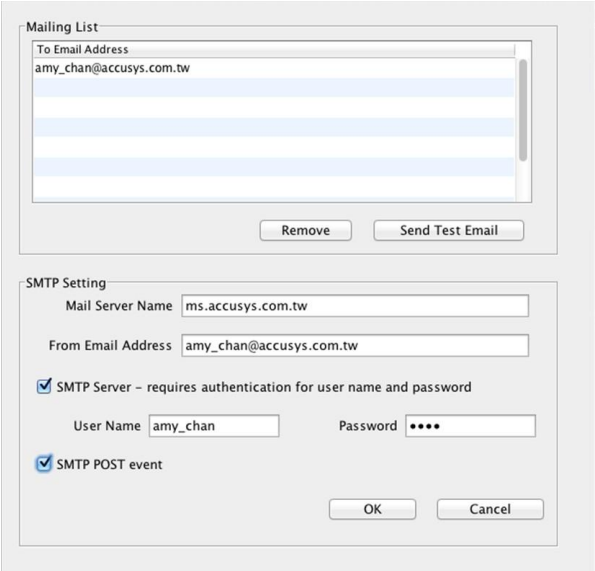


Figure 43: GUI "e-mail setting"

Preference Setting
This menu allows administrators to set the conditions of the controller, such as performance modes, caching, and miscellaneous functions.

4.2.2.4.1 Mode

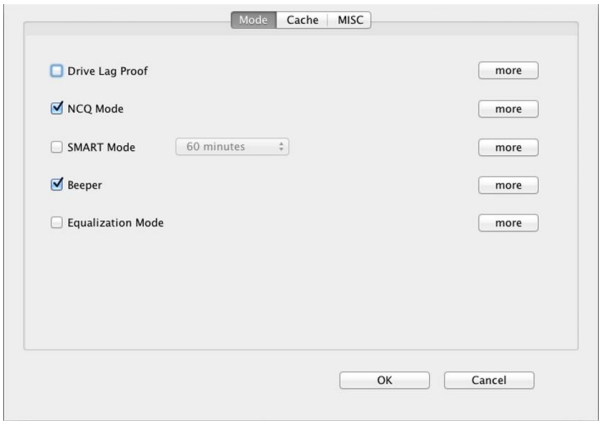


Figure 44: GUI "Mode setting"

Disk Lag Proof Mode – This feature ensures the stability and continuity of the RAID performance. In RAID 5 and RAID 6, DLP prevents the aging or slow responds of a single hard disk from influencing the overall performance. The advantage of this feature will not be felt until some hard disks fail to perform well.

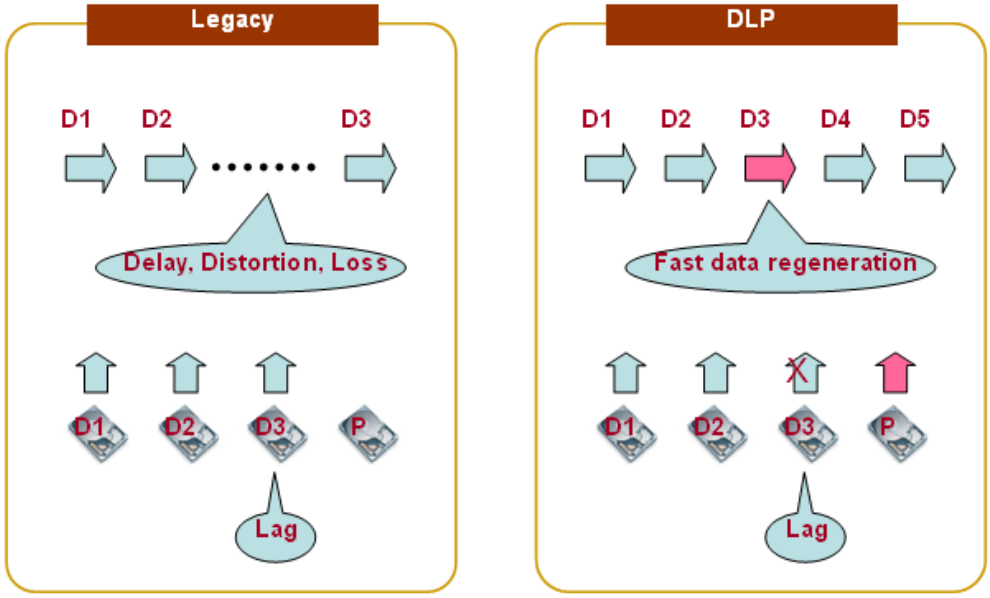


Figure 413: DLP concept

In the event of performance degradation or delay of a single drive due to aging, the ExaSAN RAID system reads both data and parity stripes concurrently. It bypasses the slow reads and returns data to the host with the regenerated data and to provide stabled performance based on the RAID parity.

> **Note**
> Although slow responds of some hard disks can be tolerated in DLP mode, you may use S.M.A.R.T. function to check the conditions of hard disks in an array and replace the faulty ones.

> **Note**
> This function does not support JBOD and NRAID.

NCQ (Native Command Queuing) – This mode is designed for increasing disk drive access on SCSI and SATA disk drives. It can do this under certain situations by allowing the individual hard disk to internally optimize the order in which it executes the read and write requests it receives. This can reduce the amount of unnecessary drive head movement and resulting in better performance for work loads where multiple read/write requests and outstanding at the same time.

This situation most often occurs in server-type applications. However, the current technology actually slows down disk drive access in certain applications, such as video editing and sequential reads and writes, because of the added latency induced by NCQ.

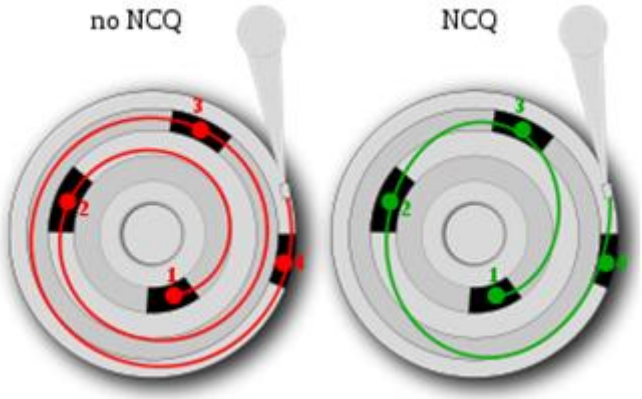


Figure 46: NCQ concept

The figure above illustrates the access sequence in NCQ and non-NCQ mode. The content sequences of the two hard disks are the same: 1, 2, 3, 4. However, the access sequence in NCQ mode may vary to improve the performance.

> **Note**
> If Equalization mode is enabled, NCQ is automatically turned off.

SMART Mode – S.M.A.R.T. is a monitoring system of disk drives to detect and report on various indicators of reliability, in the hope of anticipating failure. ExaSAN RAID system supports S.M.A.R.T. Once this function is selected, you can select the check interval from the drop-down list. Choose from 1 minute to 8 hours for SMART Mode to be active. The RAID controller will command each hard disk to perform S.M.A.R.T. according to the check interval selected. The check results will be shown as an Event message in the main menu.

When running S.M.A.R.T., the performance of the system will be slightly affected. The higher the check frequency, the more the sequential access is influenced. It is recommended to turn off S.M.A.R.T. if high frequency is needed. On the other hand, running S.M.A.R.T. constantly allows you to monitor the conditions of hard disks at any time.

Different hard disk models and brands will have different attributes in the reporting of S.M.A.R.T. Event message will show all messages generated by the hard disk.

Beeper – If the Beeper option is enabled, the system will sound an audible alarm in the event of an error. Users can respond to the error promptly and carry out troubleshooting.

If the error indicated by the Beeper alarm has been resolved, you may perform one of the following to turn off the alarm.

1. Uncheck the **Beeper** option.
2. Press the “Mute” button on the front panel.

Equalization Mode – Regardless the transmission method, the data transmission speed can not be guaranteed at all times. This feature allows the continuous I/Os to operate more

smoothly and substantially reduce large fluctuations in efficiency during data transfer. For video editing, enable equalization to prevent video frame drops.

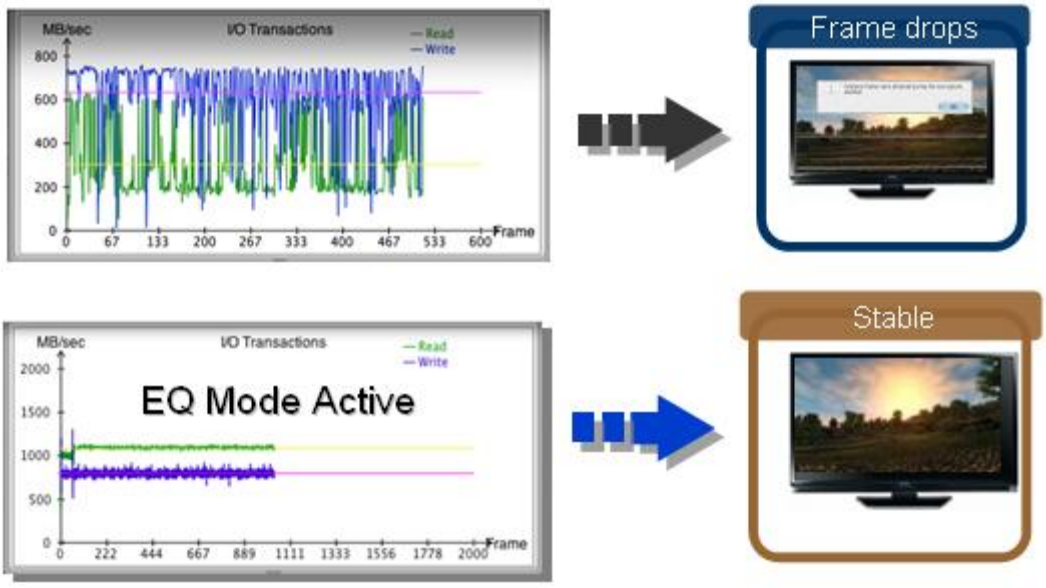


Figure 47: EQ mode concept

This mode is designed to provide smooth sequential access, such as during video editing and capture, to the RAID system. To achieve best system performance, NCQ mode is automatically turned off.

4.2.2.4.2 Cache

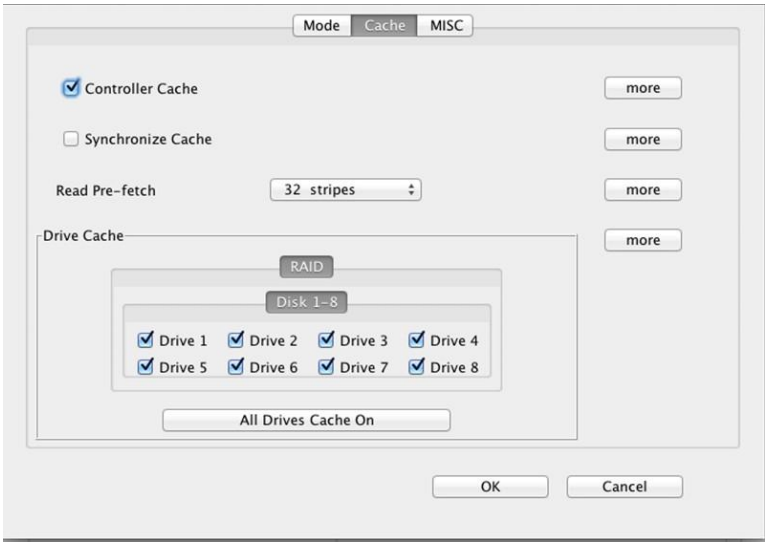


Figure 48: GUI "Cache"

Cache memory in the controller enhances read and write performance, improving overall storage throughput streaming data can be queued into the cache to dramatically accelerate read performance. Under different applications, cache has different influence on the RAID system.

Controller Cache – Check this box to enable the controller cache. This speeds up the data transfer to and from the disks.

> **Caution**
> If controller cache is enabled, it is suggested that you use a UPS (uninterruptible power supply) system to prevent a data loss scenario.

Synchronize Cache – Check this box to enable cache synchronization. When Synchronize Cache mode is disabled, the RAID controller works correctly but does not actually perform any cache flushing. For video capture, disable synchronization because the video capture needs to be able to constantly write data to the RAID storage without long SYNCHRONIZE_CACHE latency. Synchronize cache commands the controller to regularly synchronize the information on the drive and is usually used in conjunction with the UPS.

> **Note**
> This option is available if **Mode** > **Equalization Mode** is unchecked.

Read Pre-fetch – Identifies sequential access patterns and aggressively pre-fetches patters into cache. From the drop down list, choose the number of stripes to pre-fetch. The default is 32; this is the recommended number.

Drive Cache – Choose which drives to cache. When more than one application accesses the database, the first applications cache needs to synchronize with the second. Each drive contains a built in write cache; checking these boxes chooses which drives to enable the caching on. Caching improves the efficiency and speed of data transfer.

All Drives Cache On/All Drives Cache Off – Click this button to enable/disable the caching on for all available drives.

4.2.2.4.3 MISC

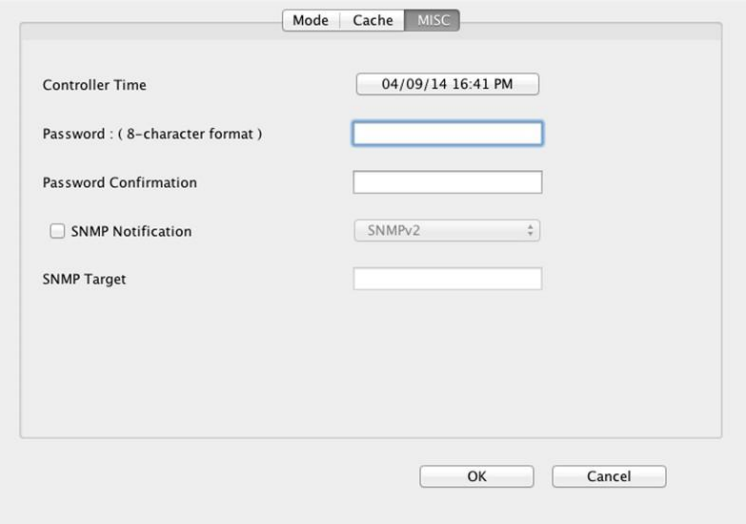


Figure 49: GUI "MISC"

MSIC (Minimal Instruction Set Computer) has standard RAID controller CPU time settings. The time of each event is displayed in the event logs in Event message.

Controller Time – Click this button to see a calendar and to change the time and date of the controller.

Password – Enter the new controller password. The default password is 00000000 (8 zeros). Type another 8 characters.

Password Confirmation – Confirm the new controller password.

> **Note:**
> Do not lose your password. If it is lost, you will have to contact your agent or the Accusys Support Team.

SNMP Notification – Select **SNMPv1** or **SNMPv2** to send notifications for error conditions and possible problems to the SNMP servers. SNMP stands for Simple Network Management Protocol.

SNMP Target – Enter the IP address for sending the SNMP notifications.

> **Note:**
> The ExaSAN RAID system supports SNMP. It can set "System on IP networks" and allows servers to manage the system remotely.

4.2.2.5 Options Function Setting

The Options menu provides the methods for changing the details of and fixing problems with the array. Click on the radio button for the required option, and then click **Next** to proceed.

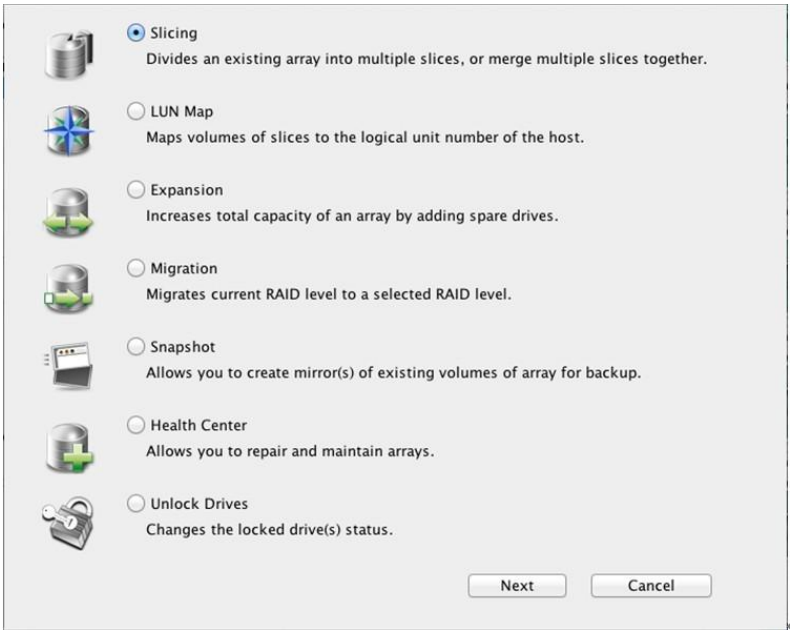

Slicing
Divides an existing array into multiple slices, or merge multiple slices together.
LUN Map
Maps volumes of slices to the logical unit number of the host.
Expansion
Increases total capacity of an array by adding spare drives.
Migration
Migrates current RAID level to a selected RAID level.
Snapshot
Allows you to create mirror(s) of existing volumes of array for backup.
Health Center
Allows you to repair and maintain arrays.
Unlock Drives
Changes the locked drive(s) status.
Next
Cancel

Figure 50: GUI "Slicing"

4.2.2.5.1 Slicing

You can subdivide a RAID array into segments, or slices. These slices are effective hardware partitions of all drives in the array. Each slice is a separate LUN and appears as a separate volume on the host computer. After slicing, the LUN map must be set for each slice.

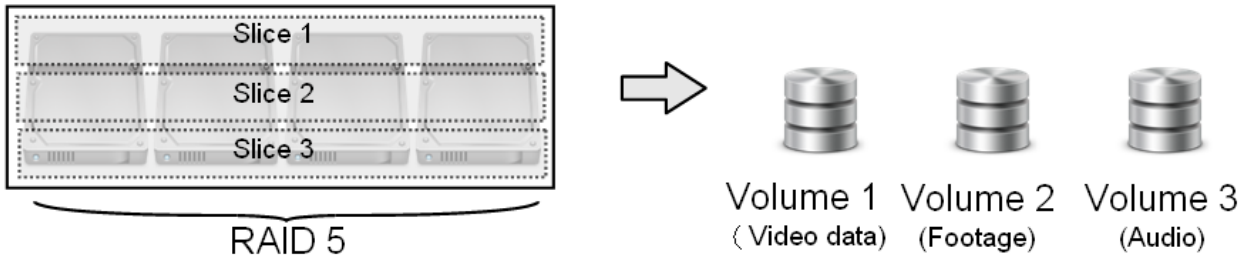
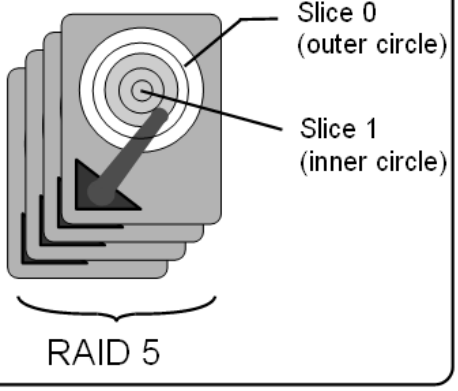


Figure51: slicing concept

Usage Scenario:

The access speed of the data stored in the outer circle is faster than that of the inner circle. Suppose that there are two slices in a hard drive. Slice 0 locates in the outer circles while Slice 1 the inner circle. In A/V making, you may store video data in Slice 0 and Audio data in random access in Slice 1.



Note
You can create up to 16 slices per array and 64 LUNs on the controller. The total number of unique arrays' slices can not exceed 16.

Follow the steps below to select an array to slice or merge.

1. Select the array to slice or merge by clicking on a drive with an array number. The capacity is displayed. By default, Slice 0 contains the entire capacity of the disk array.
2. Click on Slice 0, and use the slide bar or buttons to free space for creating other slices. Click OK to confirm.

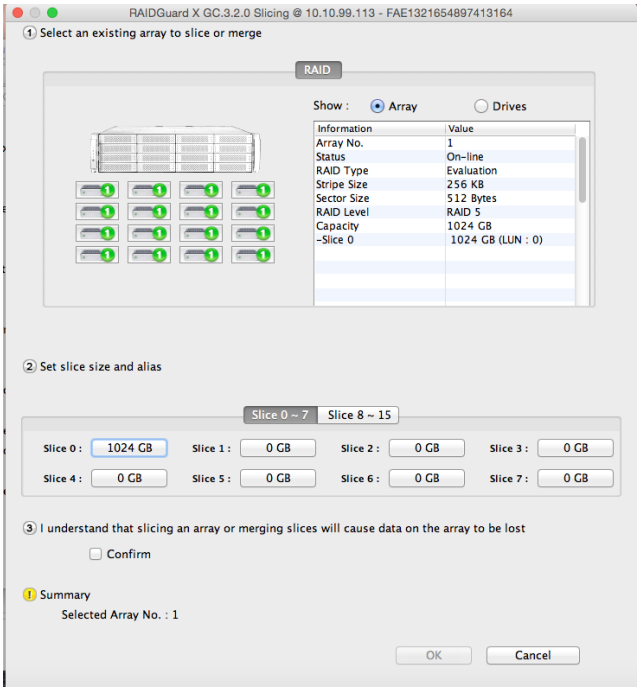

RAIDGuard X GC.3.2.0 Slicing @ 10.10.99.113 - FAE1321654897413164
1 Select an existing array to slice or merge
RAID
Show : Array Drives
Information Value
Array No. 1
Status On-line
RAID Type Evaluation
Stripe Size 256 KB
Sector Size 512 Bytes
RAID Level RAID 5
Capacity 1024 GB
-Slice 0 1024 GB (LUN : 0)
2 Set slice size and alias
Slice 0 ~ 7
Slice 8 ~ 15
Slice 0 : 1024 GB
Slice 1 : 0 GB
Slice 2 : 0 GB
Slice 3 : 0 GB
Slice 4 : 0 GB
Slice 5 : 0 GB
Slice 6 : 0 GB
Slice 7 : 0 GB
3 I understand that slicing an array or merging slices will cause data on the array to be lost
Confirm
Summary
Selected Array No. : 1
OK
Cancel

Figure 52: GUI "Slicing 1/3"

3. Click on the slice to create, and use the slider bar or buttons to adjust the size. Click **OK** to confirm.

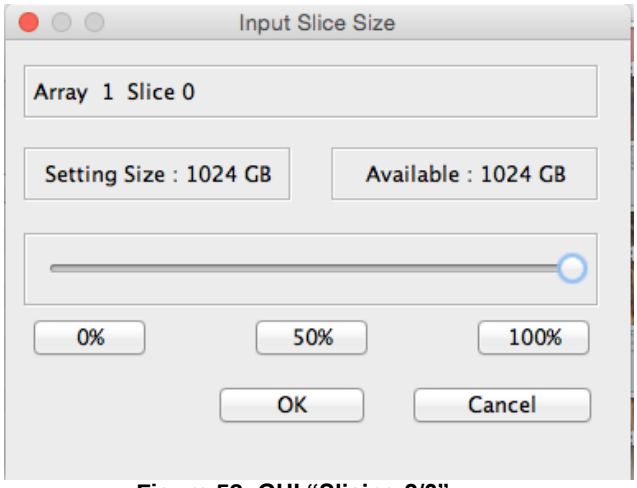
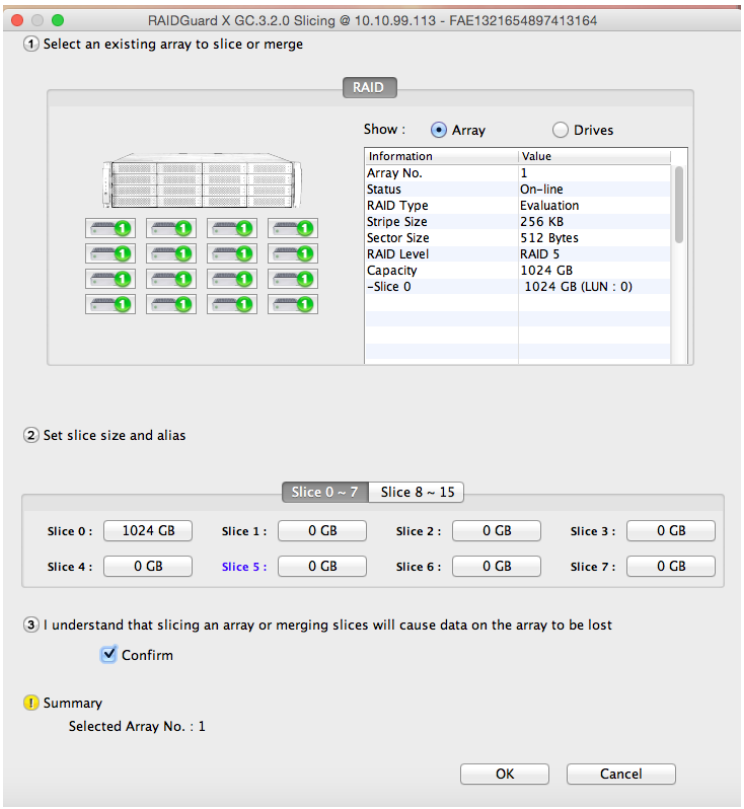


Figure 53: GUI "Slicing 2/3"

4. Check the **Confirm** box and click **OK**.



Figuren54: GUI "Slicing 3/3"

> **Note**
> Slices must be adjusted in order; for example - Slice 0, Slice 1, Slice 2, etc.
>
> Each array supports a maximum of 16 slices.

LUN Map

LUN, which stands for **L**ogical **U**nit **N**umber, is used to identify a logical unit in computer storage. When creating an array, you may select **Assign LUN automatically** to automatically assign a LUN to the new array. If **Assign LUN automatically** is not selected, you need to assign the LUN manually using LUN map. If the slice has been partitioned, you need to set its LUN Map.

> **Note**
> One slice can only be assigned one LUN.

Note
The ExaSAN RAID controller supports up to 64 LUNs.

1. Select the array to map by clicking on a drive with an array number.
2. Choose a LUN and from the drop down list select a slice to map to. Repeat for multiple LUNs.

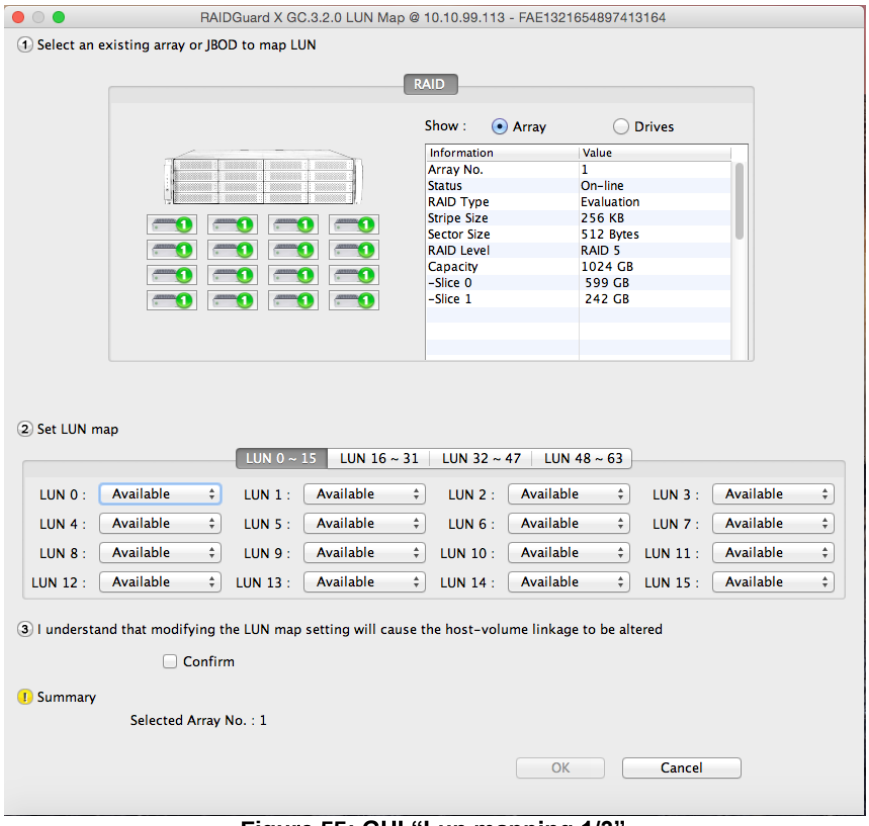

RAIDGuard X GC.3.2.0 LUN Map @ 10.10.99.113 - FAE1321654897413164
1 Select an existing array or JBOD to map LUN
RAID
Show : Array Drives
Information Value
Array No. 1
Status On-line
RAID Type Evaluation
Stripe Size 256 KB
Sector Size 512 Bytes
RAID Level RAID 5
Capacity 1024 GB
-Slice 0 599 GB
-Slice 1 242 GB
2 Set LUN map
LUN 0 ~ 15
LUN 16 ~ 31
LUN 32 ~ 47
LUN 48 ~ 63
LUN 0 : Available
LUN 1 : Available
LUN 2 : Available
LUN 3 : Available
LUN 4 : Available
LUN 5 : Available
LUN 6 : Available
LUN 7 : Available
LUN 8 : Available
LUN 9 : Available
LUN 10 : Available
LUN 11 : Available
LUN 12 : Available
LUN 13 : Available
LUN 14 : Available
LUN 15 : Available
3 I understand that modifying the LUN map setting will cause the host-volume linkage to be altered
Confirm
Summary
Selected Array No. : 1
OK
Cancel

Figure 55: GUI "Lun mapping 1/3"

3. Check the **Confirm** box and click **OK**.

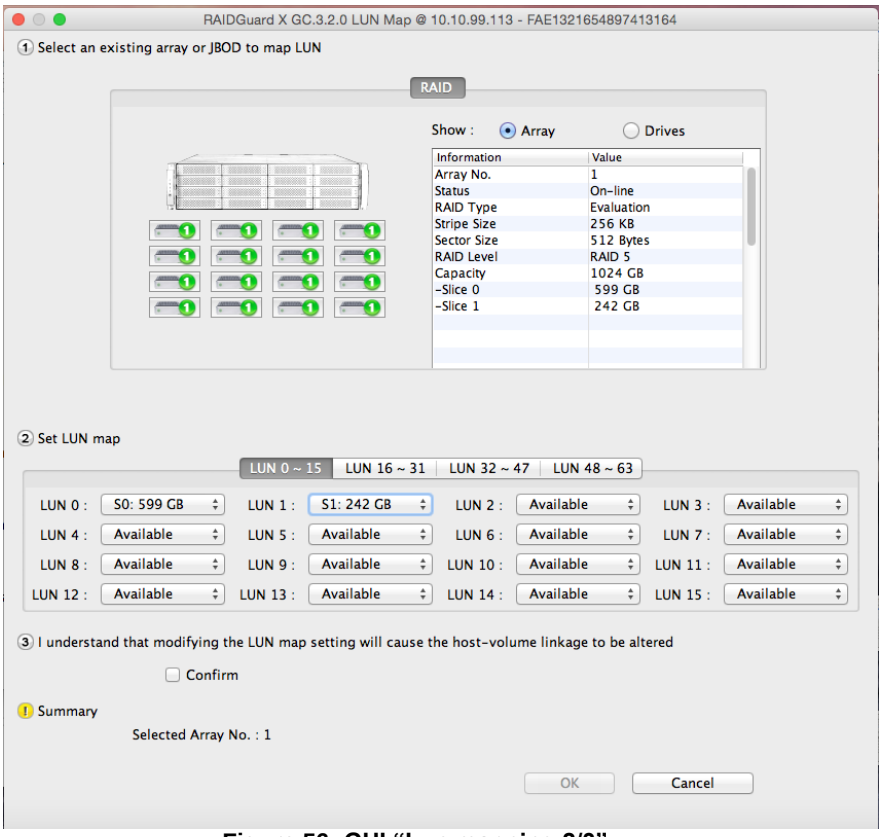

RAIDGuard X GC.3.2.0 LUN Map @ 10.10.99.113 - FAE1321654897413164
1 Select an existing array or JBOD to map LUN
RAID
Show : Array Drives
Information Value
Array No. 1
Status On-line
RAID Type Evaluation
Stripe Size 256 KB
Sector Size 512 Bytes
RAID Level RAID 5
Capacity 1024 GB
-Slice 0 599 GB
-Slice 1 242 GB
2 Set LUN map
LUN 0 ~ 15
LUN 16 ~ 31
LUN 32 ~ 47
LUN 48 ~ 63
LUN 0 : S0: 599 GB
LUN 1 : S1: 242 GB
LUN 2 : Available
LUN 3 : Available
LUN 4 : Available
LUN 5 : Available
LUN 6 : Available
LUN 7 : Available
LUN 8 : Available
LUN 9 : Available
LUN 10 : Available
LUN 11 : Available
LUN 12 : Available
LUN 13 : Available
LUN 14 : Available
LUN 15 : Available
3 I understand that modifying the LUN map setting will cause the host-volume linkage to be altered
Confirm
Summary
Selected Array No. : 1
OK
Cancel

Figure 56: GUI "Lun mapping 2/3"

4. If you attempt to assign a LUN to a slice that has already been assigned a LUN, a warning prompt appears.

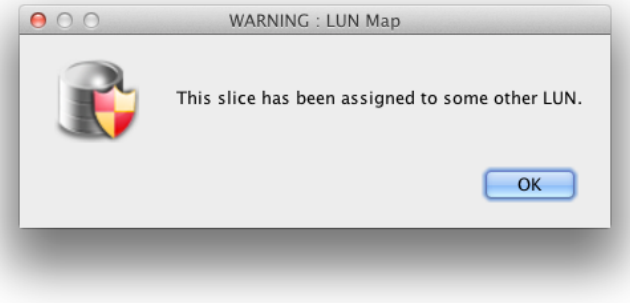


Figure 57: GUI "Lun mapping 3/3"

4.2.2.5.2 Expansion

Expansion adds spare disks or new hard drives to an existing array. This is no need to create a new array or stop an array; you may add new disks online while the array is in use. Expansion can enlarge the capacity and frequency of an array. Although you may still access the array while doing Expansion, its performance is affected considerably. You may check the progress of Expansion in the main view.

Example:

Figure 58: Expainsion concept

> **Note**
> The storage capacity of a new hard drive must be no smaller than the other disks in the array.

Follow the steps below to select an array to expand.

1. Select the array to add additional drives to, and select the number of drives to be added. A "+" sign appears above the drives to be added.
2. Check the **Confirm** box and click **Expand Array**.

> **Note**
> It is only the number of drives that can be chosen, not the specific drive.

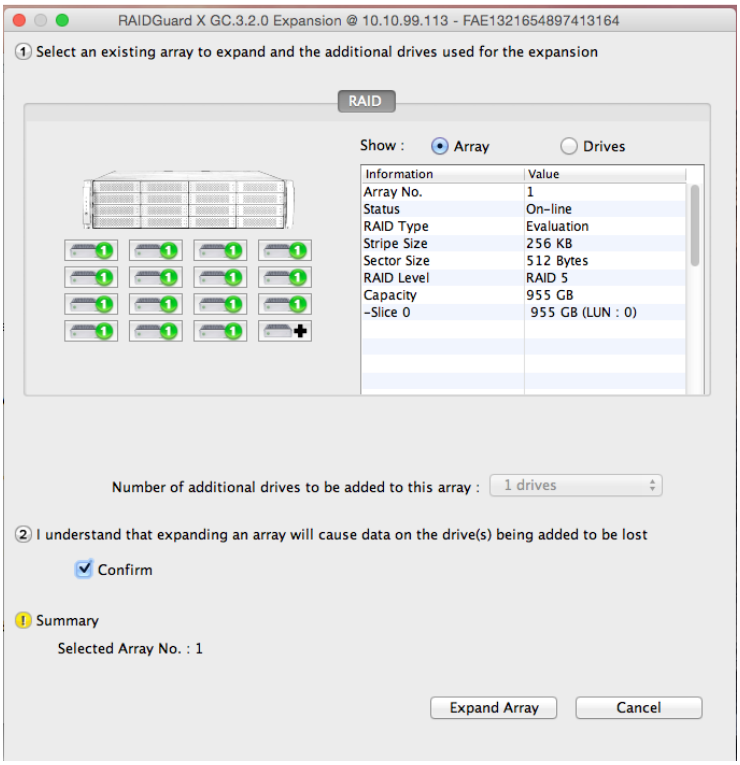

RAIDGuard X GC.3.2.0 Expansion @ 10.10.99.113 - FAE1321654897413164
1 Select an existing array to expand and the additional drives used for the expansion
RAID
Show : Array Drives
Information Value
Array No. 1
Status On-line
RAID Type Evaluation
Stripe Size 256 KB
Sector Size 512 Bytes
RAID Level RAID 5
Capacity 955 GB
-Slice 0 955 GB (LUN : 0)
Number of additional drives to be added to this array : 1 drives
2 I understand that expanding an array will cause data on the drive(s) being added to be lost
Confirm
Summary
Selected Array No. : 1
Expand Array
Cancel

Figure 59: GUI "expansion 1/2"

3. The Main array information screen will indicate that the array is currently under expansion.

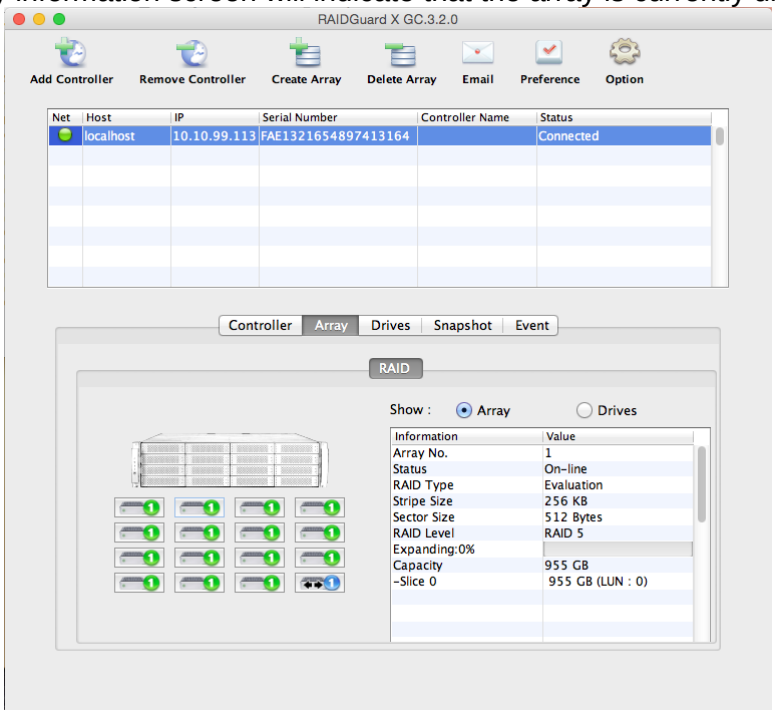


Figure 60: GUI "expansion 2/2"

4.2.2.5.3 Migrations

Different from Expansion, which enlarges an array by adding hard drives to a fixed RAID level, Migration changes the RAID level of an array. It allows live changes to the RAID without the need to delete the array and rebuild. This can be useful when new drives have been added, and a new array type needs to be created.

The number of drives required for migrations to different RAID levels varies.

Example 1:
RAID 5 (12 drives) –Migrating→ RAID 0 (>11 drives)
RAID 5 (12 drives) –Migrating→ RAID 6 (>13 drives)
RAID 5 (12 drives) –Migrating→ RAID 0+1 (>22 drives)

Example 2:

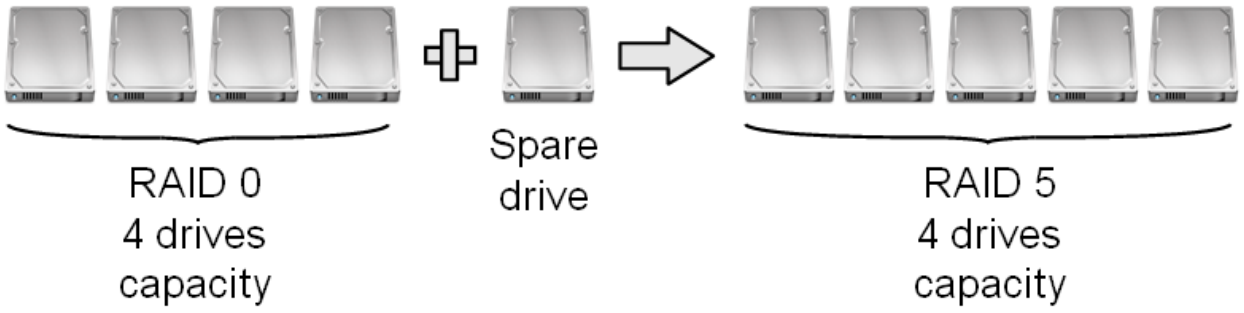


Figure 61: Migration example 2

Example 3:

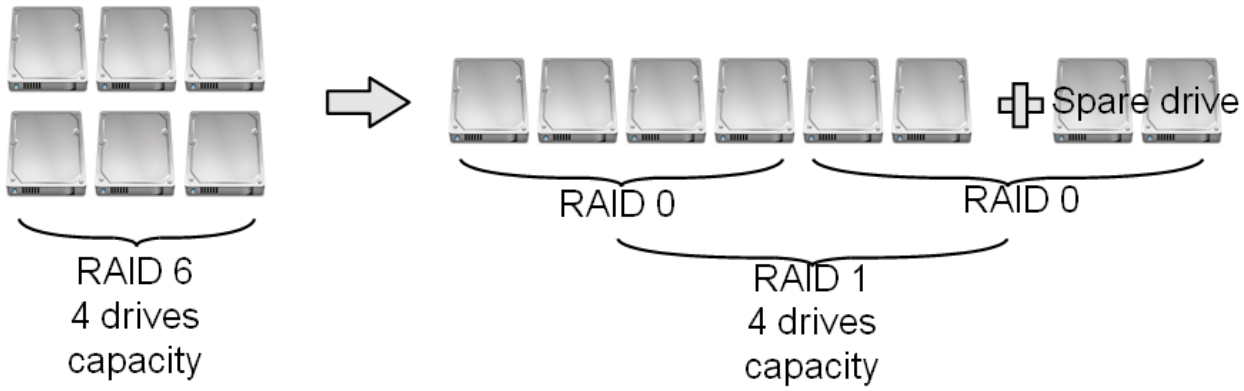


Figure 62: Migration example 3

> **Note**
> The capacity of an array after migration can not be smaller than the capacity of the array before migration.

Follow the steps below to select an array to migrate. This changes the RAID level, such as from RAID 1 to RAID 5.

1. Select the array to migrate. From the drop down menu, select the RAID level to migrate to, and then select the total number of drives to include in the array. A “+” appears above the drive(s) to be added, and a “-” sign above the drive(s) to be removed.
2. Check the **Confirm** box and click **Migrate**.

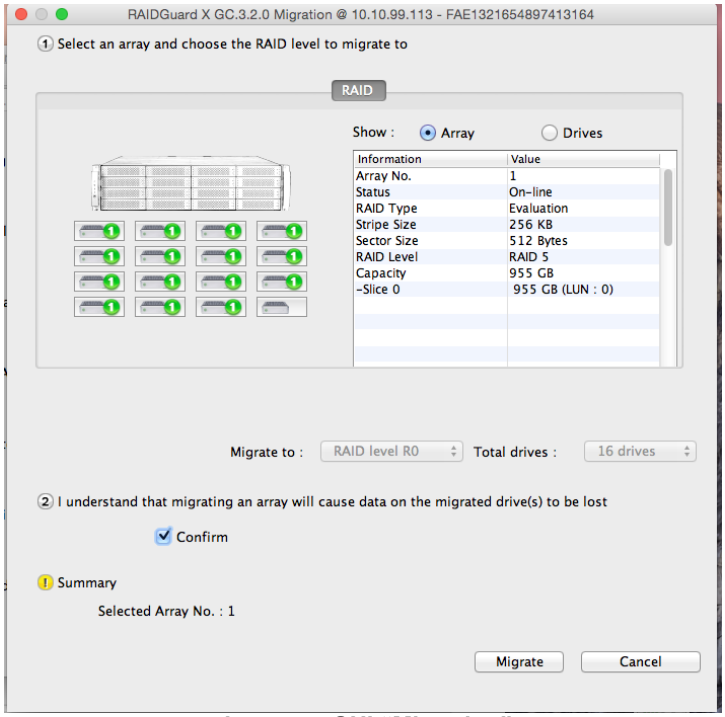

RAIDGuard X GC.3.2.0 Migration @ 10.10.99.113 - FAE1321654897413164
1 Select an array and choose the RAID level to migrate to
RAID
Show : Array Drives
Information Value
Array No. 1
Status On-line
RAID Type Evaluation
Stripe Size 256 KB
Sector Size 512 Bytes
RAID Level RAID 5
Capacity 955 GB
-Slice 0 955 GB (LUN : 0)
Migrate to : RAID level R0
Total drives : 16 drives
2 I understand that migrating an array will cause data on the migrated drive(s) to be lost
Confirm
Summary
Selected Array No. : 1
Migrate
Cancel

Figure 63: GUI “Migration”

3. The main array information screen will indicate that the array is currently migrating.

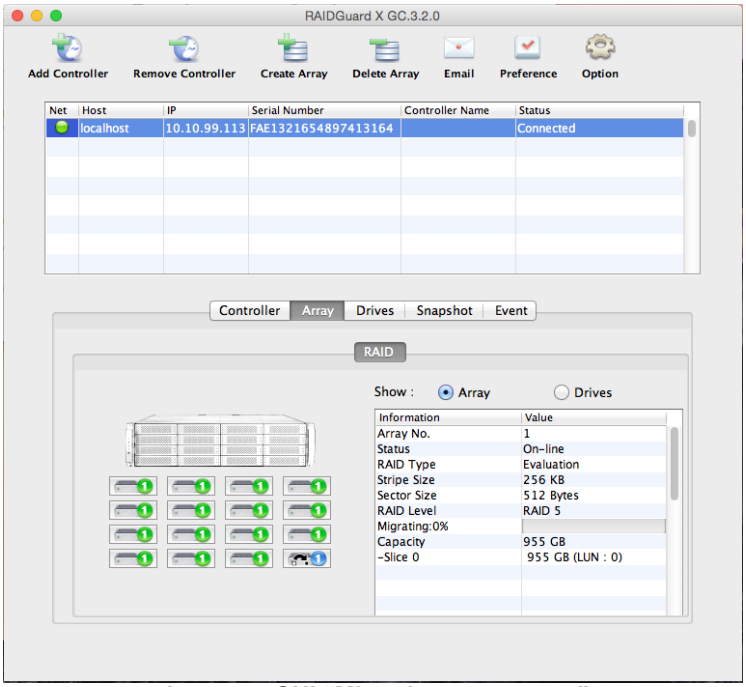


Figure 64: GUI “Migration percentage”

4.2.2.5.4 Snapshot

A snapshot is initialized with a data sync task running in the background to duplicate the data from a source to a target. The host I/O data is also replicated in the target. The mirror snapshot is offered by the ExaSAN RAID controller.

> **Note**
> The source and target volume of the snapshot must be identical.

Before setting a snapshot, you need to set the slice in the array. The capacity of each slice and the number of shots should be in accordance with the space you need.

Suppose that an array has the capacity of 30 TB, you may divide it into three slices of 10TB. You must set the LUN map for the first slice. Setting the LUN map for the other two slices is not required.

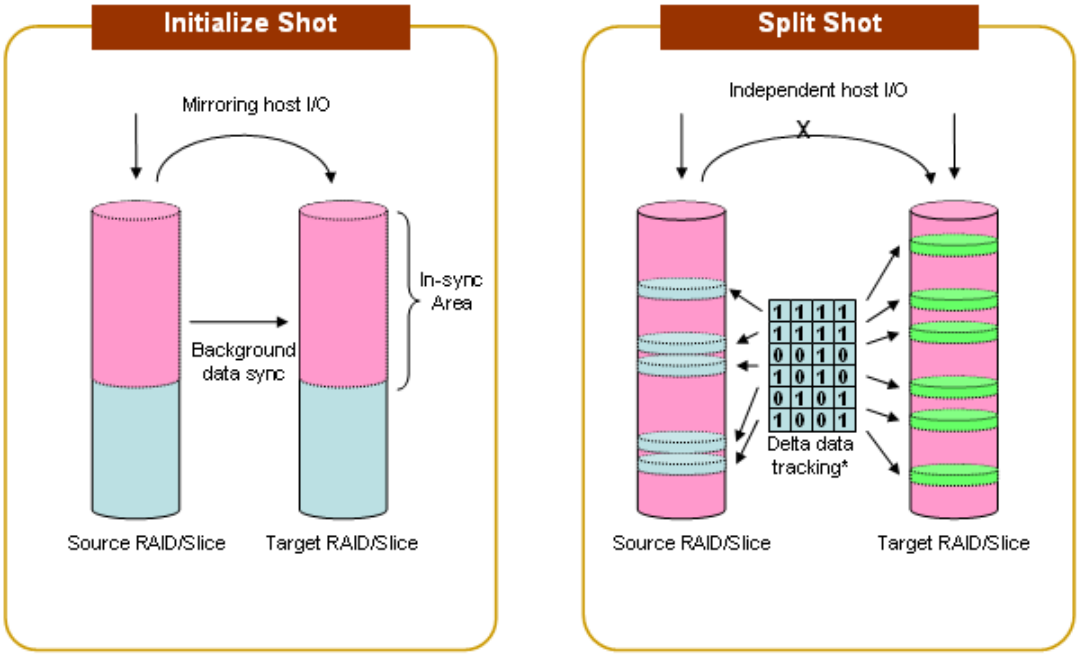


Figure 65: Snapshot concept

In the figure above, a snapshot can be created by splitting the source and target after the background sync is completed. The I/O mirroring is stopped, and the difference is under tracking in a bitmap table to support fast re-sync.

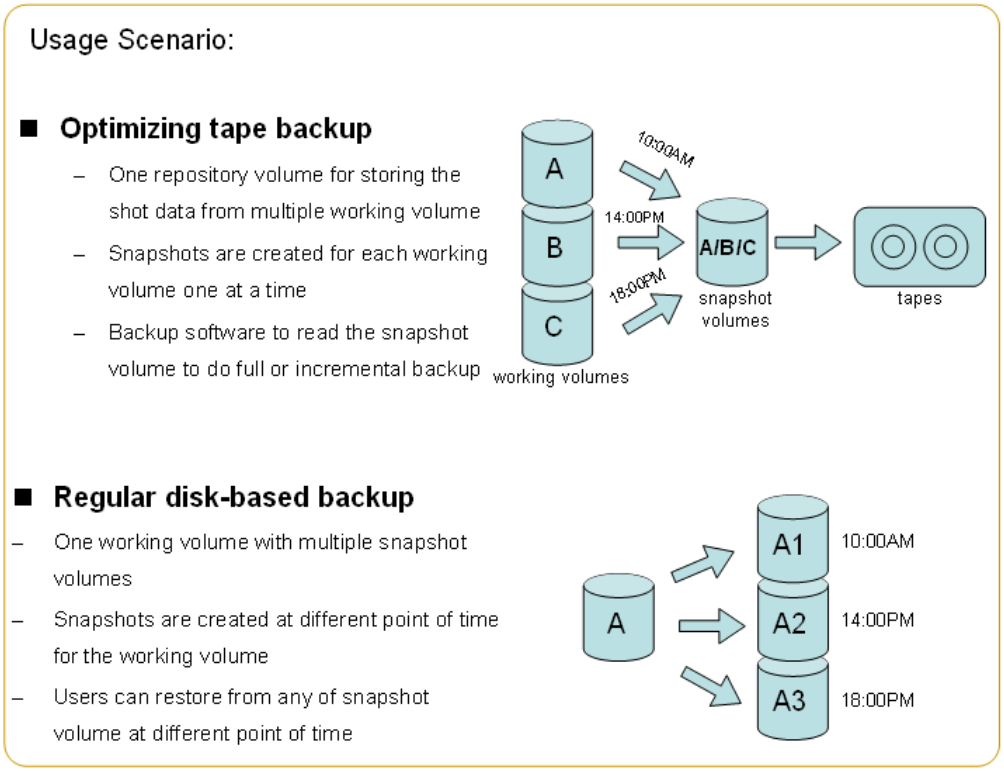


Figure 66: Two types of snapshot function

Create Shot

Create a snapshot of the selected slice. A maximum of 8 shots can be created. Once all shots have been used, older shots must be deleted before new ones can be taken.

1. Select the **Create Shot** function from the drop down menu.
2. Select the required shot by clicking on the Shot No. radio button. From the respective drop down menus, select the source volume and destination volume. Unavailable shots are grayed out.
3. Check the **Confirm** box and click **OK** to take a snapshot.

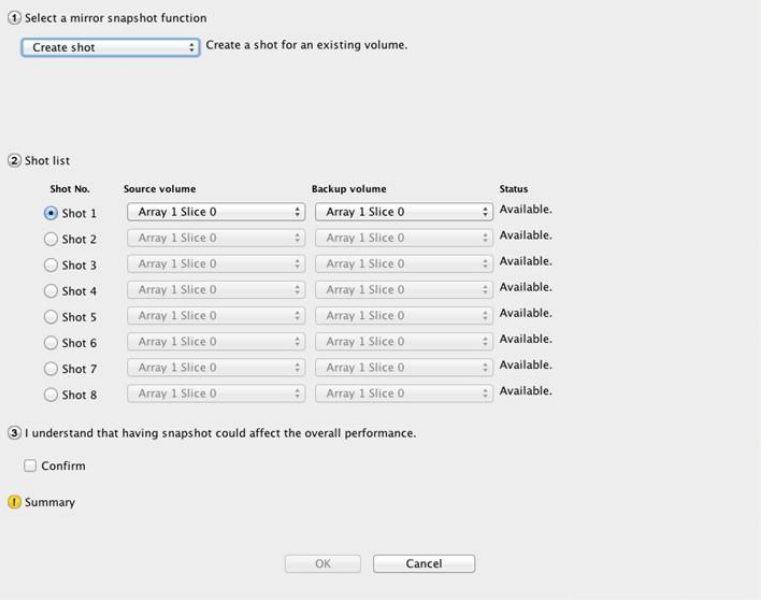


Figure 67: GUI "Snapshot setting 1/2"

Delete Shot

Delete the selected shot.

1. Select the **Delete Shot** function from the drop down menu.
2. Select the required shot by clicking on the Shot No. radio button. From the respective drop down menus, select the source volume and destination volume. Unavailable shots are grayed out.
3. Check the **Confirm** box and click **OK** to delete a snapshot.

Split Shot

Split Now –

Split the selected shot or changes scheduling. The shot is split and read as two separate shots; therefore, it becomes two separate slices after being split.

1. Select the **Split Shot** function from the drop down menu.
2. Select the Split Now radio button.
3. Select the required shot by clicking on the Shot No. radio button. From the respective drop down menus, select the source volume and destination volume. Unavailable shots are grayed out.
4. Check the **Confirm** box and click **OK** to split the snapshot.

Split Scheduling –

Set any time to split shot.

1. Select the **Split Shot** function from the drop down menu.
2. Select the Split Scheduling radio button.
3. Click on the time and date button to set split time.
4. Select the required shot by clicking on the Shot No. radio button. From the respective drop down menus, select the source volume and destination volume. Unavailable shots are grayed out.

5. Check the **Confirm** box and click **OK** to split the snapshot.

Cancel Scheduling –
Cancel the split shot scheduling.

1. Select the **Split Shot** function from the drop down menu.
2. Select the Cancel Scheduling radio button.
3. Select the required shot by clicking on the Shot No. radio button. From the respective drop down menus, select the source volume and destination volume. Unavailable shots are grayed out.
4. Check the **Confirm** box and click **OK** to split the snapshot.

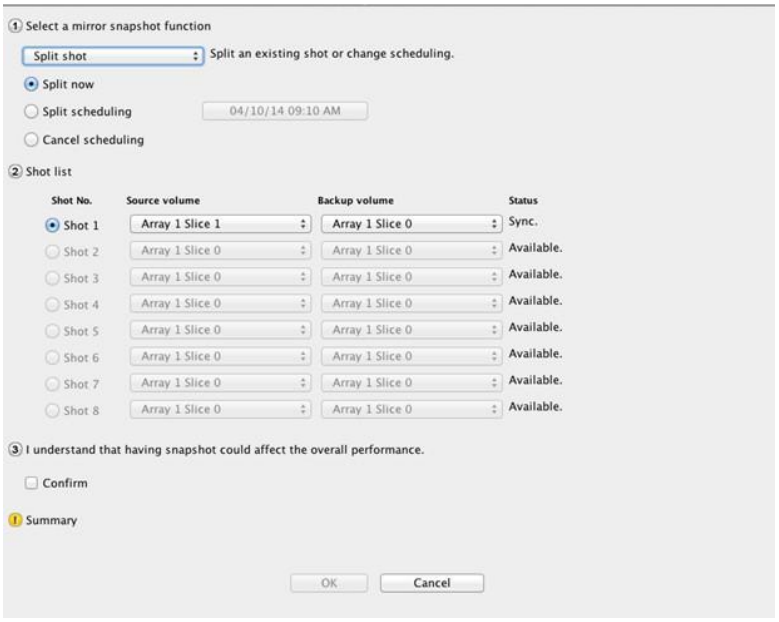


Figure 68: GUI "Snapshot setting 2/2"

Resynchronize Shot
Resynchronize the selected shot. This function can speed up mirroring for previous snapshots.

1. Select the **Resynchronize shot** function from the drop down menu.
2. Select the required shot by clicking on the Shot No. radio button. You can only select split shot for resynchronization.
3. Check the **Confirm** box and click **OK** to split the snapshot.

Note
1. The destination volume must be equal or larger in size than the source volume.
2. The source volume and the destination volume can be on different arrays.
3. The destination volume must NOT be mapped to a LUN.
4. A shot will not be deleted if the details of the array change. The only way to delete a shot is using the Delete Shot function under Snapshot.

Health Center

To ensure the accuracy of the RAID parity data, ExaSAN RAID controller offers Background checking and “Rebuild parity data”. During checking or rebuilding parity, the performance of the array will be affected. You may check the progress of in the Main view or in the Health Center.

Follow the steps below to select an array to verify, rebuild, or condition.

1. Select the Array to verify, rebuild, or condition.
2. Click the radio button to:

   Rebuild the parity data – Rebuilding parity on an array uses the data on the array to create new parity data, no repair problems with the data.

   Verify the parity data – Verify that the data is free of errors.

   Refresh array data and parity – Select the priority between Low, Med., or High. This process scans, rewrites, and scrubs bad data conditions caused by excessive vibration during drive I/Os, or data degradation caused by Adjacent Track Interference (ATI).

3. Click OK to start the operation.

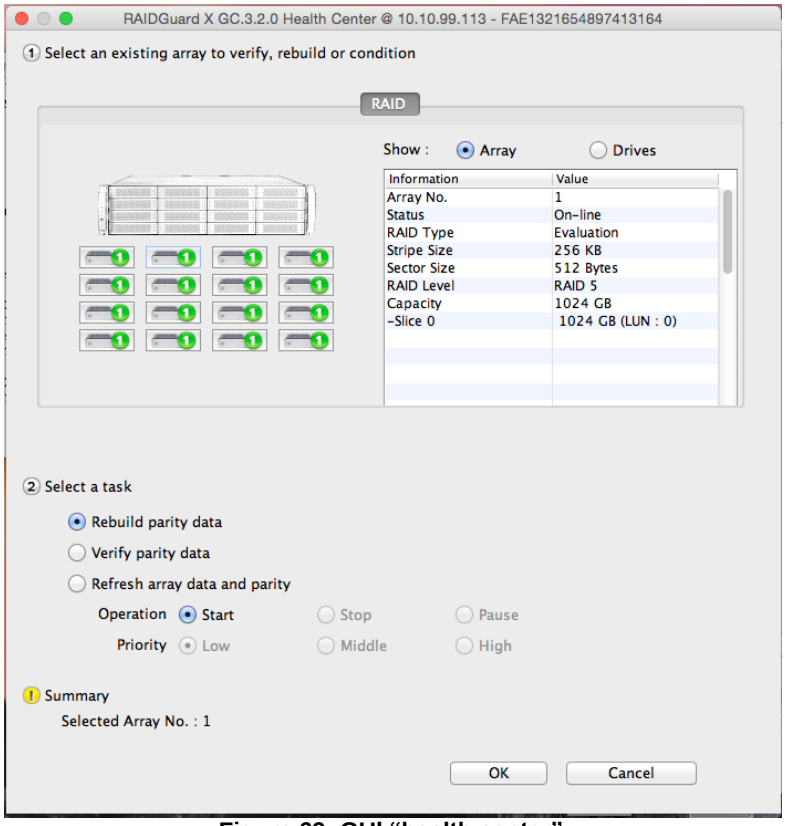


Figure 69: GUI “health center”

4. The main array information screen will indicate that the array is undergoing rebuilding, verification, or refreshing.

4.2.2.5.5 Unlock Drives

The RAID controller may lock abnormal drives in an array. You may unlock these drives and rejoin them in an array. Drives may be locked with one of two conditions:

1. If a drive returns data too slowly, the controller determines the drive is experiencing a fault and executes Drive Drop. When you unlock the drive, it will be added directly to the array if there has not been drive access during the locked period. Otherwise, the controller will rebuild parity data on the drive when the drive is online.

> **Note**
> If “Drive Drop" occurs, it is recommended to use S.M.A.R.T. to check the drive condition and replace it if necessary.

2. When replacing a damaged drive with a new one, the newly added drive might be locked. Click Unlock to allow the array to rebuild the drive. You can check the rebuild progress in the Main view.

> **Note**
> The time required for on-the-fly initialization, drive building, online expansion and migration may vary according to the capacity of the drive and the array.

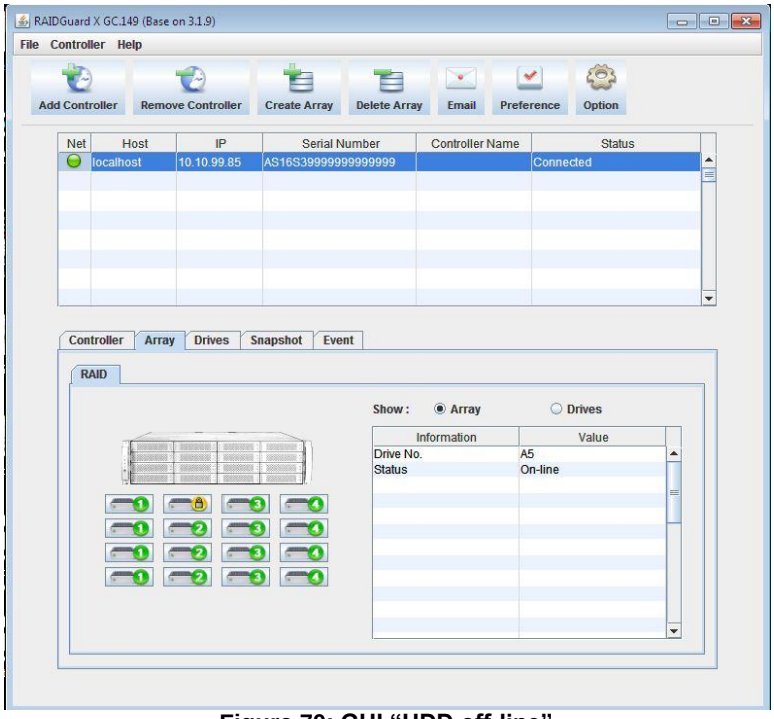


Figure 70: GUI “HDD off-line”

Follow the steps below to select a drive to unlock or change the ID.

Locked drives prevent the accidental loss of user data when drives are installed one at a time, or a RAID member is accidentally removed while the controller is powered on. The meta-data and user data on the locked drives are preserved for online/offline recovery. If users don't need the data or the locked drive anymore, the locked drive can be changed into a spare drive by the command of Unlock Drive.

1. Select the drive with the icon. It will change to the icon.

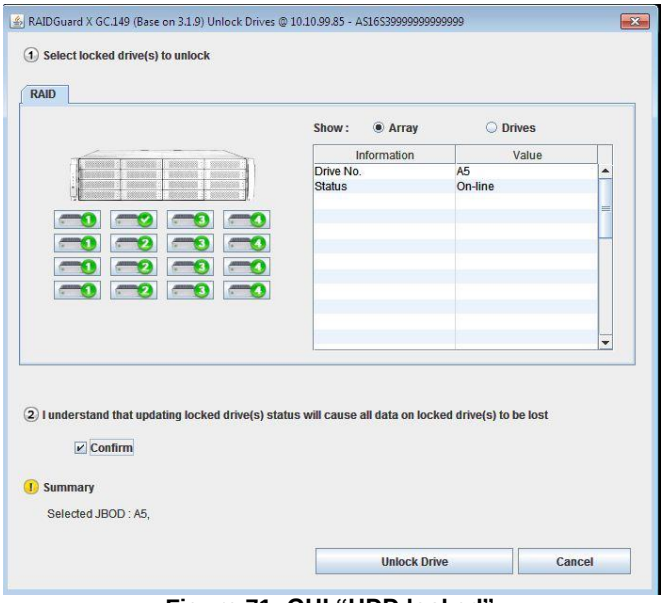


Figure 71: GUI "HDD locked"

2. Check the **Confirm** box and click **Unlock Drive**.

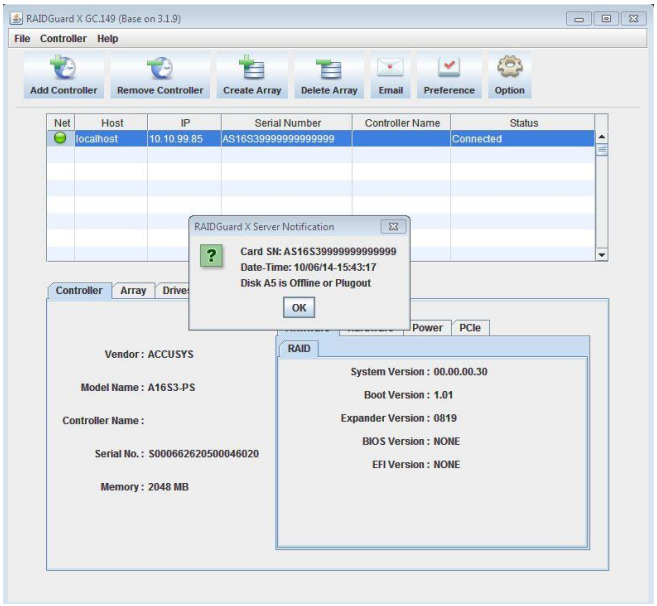


Figure 72: GUI "Unlock HDDs"

4.2.3 Updating the ExaSAN RAID system Firmware

Follow the steps in this section to update the firmware of your ExaSAN RAID system. Use caution to prevent a loss of power to the ExaSAN RAID system during this process.

4.2.3.1 Preparing the Firmware Update Files

1. Note the current System Version, Boot Version, BIOS Version and EFI version on your ExaSAN RAID system. These can be viewed in the Main menu firmware tab.
2. Visit the website below:
3. http://www.accusys.com.tw/support/download.htm, Under the “Download” link, you can click the folder to look for your ExaSAN system model
4. Proceed to the next section to update the firmware files.

4.2.3.2 Installing the Firmware Update Files

1. Select Controller in the Menu bar and select **Update**.

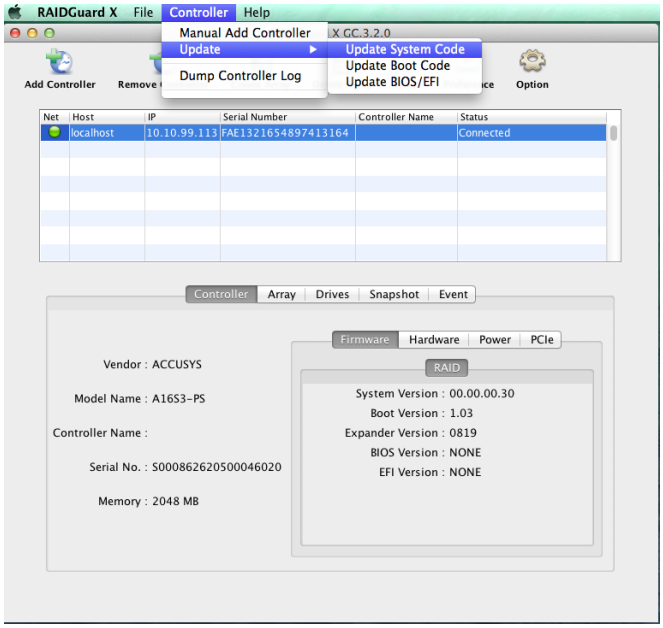


Figure 73: GUI “Update system code (firmware)”

2. Update System Code, Boot Code, BIOS/EFI individually from the download path. During the update process, the RAID system will stop all data access.

> **Caution**
> Do NOT interrupt or stop updates that are in progress.

3. Once the updates are complete, make sure to power off the ExaSAN RAID system and host using the proper power down sequence and then power on, again following the proper power on sequence.

5. RAID Overview

5. RAID Overview

This chapter gives an overview of RAID storage system within the context of recommended setting of ExaSAN based SAN environment to provide fast, shared storage to client computers.

5.1 How RAID Works

RAID, or Redundant Array of Independent Disks, is a data-storage technology that spreads data across multiple drives. This technology provides several benefits over a single large hard disk, including:

- Data redundancy for protection and availability
- Higher performance as a result of reading or writing on several drives simultaneously
- Scalability for expansion of storage

The ExaSAN-family RAID systems use a hardware controller, which manages up to 48 HDDs. By segmenting and writing or reading data on multiple drives simultaneously, the RAID controller achieves fast and highly efficient storage and access.

The way the controller stores and retrieves data on the RAID system is determined by the RAID level and storage method you choose. For ExaSAN applications, the recommended setting is mainly RAID 1 and RAID 5, which will be discussed in details later in this chapter.

Once you have defined a group of drive modules as a RAID set, the controller groups those drives into “logical disks.” On the ExaSAN RAID system, each logical disk appears to the client system as one Logical Unit (LUN), regardless of the number of actual drives in that logical unit.

5.2 Data Storage Methods

The controller stores and retrieves data on a RAID system using techniques such as “data striping”, “data mirroring”, and “data parity”.

5.2.1 Data Striping

Multiple hard disk drives in a RAID group, referred to as a “set” or “array,” are divided (partitioned) into stripes. The controller spreads stripes across the disks in alternating sections on each drive.

In data-intensive environments such as digital video editing, performance is optimized by writing data across small stripes, so that each record spans all drives. This method ensures that access to large records is very fast because data is transferred in parallel across multiple drives.

5.2.2 Data Mirroring

To mirror data, the RAID controller duplicates all data on two different disks. One disk is the primary; the other is the mirrored disk. The primary and mirrored disks are synchronized; that is, anything written to one disk is also written to the other. Mirrored data is very secure because if one disk fails, the data is available from the other disk.

5.2.3 Data Parity

The controller can generate “parity” for the ability to protect and rebuild data. Parity protects stored information without requiring data mirroring. When data is protected by parity, it is still available if a drive fails. Parity-protected data is reconstructed using the parity formula. You can remove and replace a failed disk (known as “hot swapping”), and the controller then rebuilds the data using the information on the remaining drives.

5.3 RAID Levels

The ExaSAN RAID system supports several RAID levels and configurations. Each level has a different architecture and provides varying degrees of performance and fault tolerance. Each level has characteristics to achieve maximum performance or redundancy depending on the data environment.

5.3.1 RAID 0: Striping

RAID level 0, striping only, is the fastest and most efficient array type, but offer no fault-tolerance. Any drive failure destroys the data in the array.

5.3.2 RAID 1: Mirroring

RAID level 1, mirroring, has been used for Metadata LUN because of its simplicity and high levels of reliability and availability. Mirroring uses two drives, each drive stores identical data. RAID 1 provides very high data reliability and improved performance for read-intensive applications, but this level has a high capacity cost because it retains a full copy of your data on each drive in mirror set.

In a RAID 1 configuration, the capacity of the smallest drive is the maximum storage area.

5.3.3 RAID 5: Independent data disks with distributed parity

By distributing the parity information across all drives in a set, RAID level 5 achieves high reliability and data availability. It also offers the highest read data transaction rate of all levels along with a medium write rate. The low ratio of ECC (Error Correction Code) parity disks to data disks offers hardware efficiency. Disk failure has a moderate impact on the total transfer rate.

5.3.4 RAID 6: Independent data disks with two Independent parity schemes

RAID level 6 extends RAID level 5 by adding an additional parity block; thus it uses block-level striping with two parity blocks distributed across all member disks. RAID 6 does not have a performance penalty for read operations, but it does have a performance penalty on write operations because of the overhead associated with parity calculations.

RAID 6 is no more space inefficient than RAID 5 with a hot spare drive when used with a small number of drives, but as arrays become bigger and have more drives the loss in storage capacity becomes less important and the probability of data loss is greater. RAID 6 provides protection against data loss during an array rebuild, when a second drive is lost, a bad block read is encountered, or when a human operator accidentally removes and replaces the wrong disk drive when attempting to replace a failed drive.

5.3.5 RAID 0+1: Striped set with Mirroring

RAID 0+1 combines the advantages of RAID 0 and RAID 1 with none of the disadvantages. RAID 0+1 creates a mirror of the primary striped set. RAID 0+1 provides optimal speed and reliability.

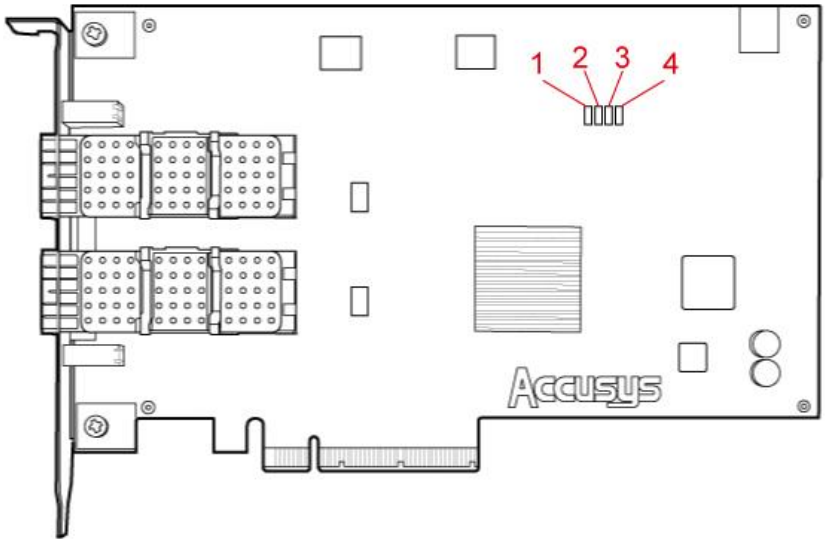
6. Appendices

Appendix A: FAQs

1. **Q: Why is my disk LED status RED?**
   A: This is likely caused by a faulty hard drive. Replace the faulty drive as soon as possible to protect your data.

2. **Q: After an array has been created in RAIDGuard X, but the host does not find the array volume.**
   A: Please check the LUN Mapping to ensure the array volume has been corrected mapped to a LUN. If this is not the case, try restarting the system and it will be automatically recognized.

3. **Q: What does the four LEDs on the Host Bus Adapter mean?**
   A: The four LED indicate the connection status of the HBA.
   LED 1: HBA card properly connect to the PCIe slot on the motherboard
   LED 2: The upper QSFP connector is active as SAN mode
   LED 3: The lower QSFP connector is active as DAS mode
   LED 4: The HBA card is failure, system disconnected



4. **Q: Why doesn't the performance reach the expected levels while testing the A16S3-PS? Why isn't the performance steady enough?**
   A: If the performance is unsteady or not achieving the expected level, in many cases, the HDD is the cause. Since the A16S3-PS is a highly efficient product, there is extreme demand placed on each HDD. As a result, it is strongly recommended to use the newest enterprise level HDD.

5. **Q: Why is the A16S3-PS generating warning beeps?**
   A: Please check the LED indicators on the A16S3-PS front panel against the appropriate user documentation for your particular storage system. Launch RAID Guard X to obtain Event Log information for further analysis. For detail definition of warning beeper, please refer to chapter 1.4.1.2

6. **Q: If "Find no RAID card" appears in a Windows host server, how can this be resolved?**
   A: Please make sure the PCIe cable is properly connected to the back of the host server and the RAID system. Check the Device Manager in Windows to confirm that the correct driver has been installed for the HBA. If both conditions have been verified and the problem persists, please run RAIDGuardX Server again, or using "Manually Add Controller" option.

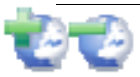
7. **Q: On a MAC host, after entering the GUI and adding a controller, there is no device listed. How can this be resolved?**
   A: Please first confirm whether the hardware environment of the RAID system is functional. Also, ensure that the system drivers have been correctly installed. Next, go to "**Utilities > System Information> Software > Extensions"** and check whether ACS6x.kext is listed. Reload RAID Guard X Server service / Libaray/ StartupItems/ RGX_Accusys/ **DTRGuiSrv01_64** If the situation persists, please verify again that the hardware environment is not the source of the problem and reinstall using the MAC installer.

8. **Q: In Windows 7, after having confirmed that the files on the installation CD have been completely installed, why does it still show "Find no RAID card"?**
   A: Windows 7 has a built-in ability to automatically reduce the potential of security breaches in the system. It does that by automatically enabling a feature called User Account Control (UAC). When UAC is enabled, the RAIDGuard X server cannot detect the controller and thus displays the message "Find no RAID card." To resolve this, disable UAC and run RAIDGuard X server as "administrator".
   a. Type "MsConfig" in Start Search to start System Configuration. Then go to Tools tab, select Change UAC settings, then click on Launch button.
   b. Slide the slider bar to the lowest value (towards Never Notify) with the description showing "Never notify me".
   c. Restart the computer to turn off UAC.

9. **Q: When inserting the HDD into my A16S3-PS, why does RAIDGuard X show the HDD mode as Lock?**
   A: The lock indicates that the HDD has been previous used in Accusys products and that it contains a portion of a RAID data. If the data can be deleted, you can unlock the HDD.

10. **Q: I have connected the cable to the Host server, but I can't see "new disk drive" on the host device management.**
    A: There are three possibilities:
    a. Please ensure the QSFP cable is connected securely. You should be able to hear a "click" sound when you connect the cable to the connector.
    b. Please check the connection port is correct. DAS is for host directly, SAN is for connecting to ExaSAN switches.
    c. Please check if the installer and the driver have been installed correctly. If the installation has completed and the error still persists, it may be a compatibility issue. Send an email to support@accusys.com.tw and briefly describe the problem. Be sure to include the driver error code, the motherboard (or host) model name and the OS. We will contact you to assist you in resolving the issue.

Appendix B: Icons

ICON	Description
Main Menu Icons	
	RAIDGuard X Server icon – The icon that is on the rackmount and notification area
	Add / Delete a controller – Select the controller to administer
	Create / Delete an array – Change the arrays within the RAID system.
	Preferences – Activate alarms, mode settings, cache settings, password, and controller card time.
	Email – Set the addresses to send e-mail alerts to.
	Option – Set the Slice, expansion, migration, health, disk locking, LUNs, and take a snapshot of the array.
Option Menu Icons	
	Slicing an array into several parts
	LUN Map – Assign a LUN to a slice
	Expand an array to larger capacity by adding disks
	Migrate from one RAID level to another target RAID level
	Snapshot – Create a backup of a slice
	Health Center – Repair / Maintain arrays
	Unlock – Fix locked drives
Application Icons	
	Drive icon
	Drive belongs to Array 1, 2, 3, 4
	A drive being deleted in Array 1, 2, 3, 4
	A JBOD drive being selected
	JBOD being deleted
	A drive being selected
	An offline drive
	A locked drive

	A drive being selected for expansion / migration / rebuilding
	A transition drive state during the array 1, 2, 3, 4, migration
	A transition drive state during the array 1, 2, 3, 4, expansion
	A transition drive state during the array 1, 2, 3, 4, auto-rebuild
	RAID Levels

Appendix C: Customer Service and Support

C.1 System Log

When you contact us for technical support, our support staff might ask for your system log file for troubleshooting purpose.

C.2 Contact Us

For customer services and technical support, locate an Accusys office near you from the link below:

http://www.accusys.com.tw/about-accusys/contact-us.html

Or, you may email us at support@accusys.com.tw

C.3 Our Website

Please visit our websites frequently for the most up-to-date product and support information.

All countries: www.accusys.com.tw

Korea: http://accusys.co.kr